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THE NEW PARIS

Building Regulations Regarding the Height and Projection of Buildings in the French Capital—Interests of Architectural Beauty Guarded

*By Paul Strauss**

PAUL STRAUSS

GREAT cities constantly change. They are perforce compelled to undergo a necessary evolution in proportion as the danger of urban congestion becomes more apparent. The street regulations correspond more and more to the exigencies of hygiene. More and more the great cities profit by each other's experience and help one another forward in the path of progress and of reform.

Thus, in preparing for the revision of the decrees governing the building regulations in the city of Paris, M. Louis Bonnier, a Government Architect, and Chief Secretary-Reporter to the Street Commission, has studied with the closest attention the regulations in London, Vienna, Berlin, St. Petersburg, Rome, Frankfort, Lisbon and Brussels, and more than one foreign example has served as a point of departure and a base for the proposed modifications. After a laborious inquiry and a prolonged debate, an important decree was issued on August 13, 1902, regulating the height and projection of buildings in the city of Paris. The first reform is highly important in itself, as we shall see on examining it.

But these regulations only affect the buildings bordering the public roads. The Conseil d'Etat judged it expedient to put aside or adjourn all questions connected with the private ways until the new statute concerning the public health, then in preparation, came into effect.

As this statute considerably extended and more clearly defined the powers of the municipalities in the matter of the public health, the Préfet de la Seine could instigate a definite revision of the street regulations in conformity with the provisions of the new act.

This was carried out by a special commission, the labors of which I had the honor to sum up in a report.

I.—It is curious to note that the point of departure for the reform of regulations concerning the streets of Paris was the desire to modify the rules as to the projection of the houses. Architects and builders complained with reason of the trammels which limited their scope in the ornamentation of the façades, and the artists justly decried the decree of 1882, which imposed on all the houses a dull and ungraceful uniformity.

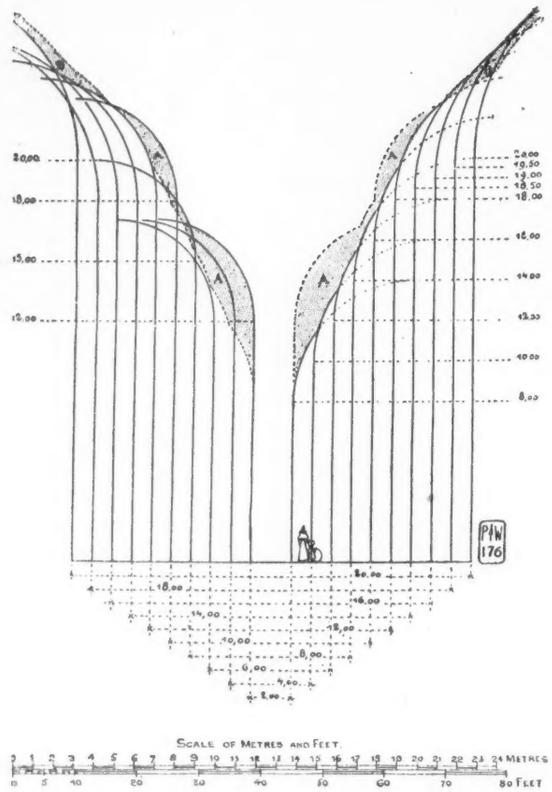
The municipal administration had itself commenced tacitly to sanction certain deviations from the too severe regulations as to the projections of buildings. Some clauses of the old regulations, moreover, were hardly intelligible, and could be interpreted in more ways than one.

A whole district of Paris—a favorite residential quarter of the artists, the Avenue de Villiers and the Parc Monceau—had shown that the progress in building construction brought about by the introduction of steel and iron into the work had made it a positive advantage to leave the architects more liberty as regards decoration of the buildings.

The shopkeepers also demanded more latitude for the projection of their signs. The high cost of ground was an obstacle in the way of putting the buildings back, in spite

* Member of the French Senate. Born at Ronchamp, Haute Saone, in 1852. At an early age he turned his attention to municipal government and public hygiene. Elected to the Municipal Council of Paris, and was Conseiller Genéral de la Seine from 1883 to 1897. He paid special attention to all matters of sanitation. His name is connected with various useful innovations in Paris. Elected to the Senate in 1897, he took a prominent part in the work of the Commission on the Sanitary Regulations of Paris. He was connected with the Comité Consultatif d'Hygiène Publique de France, the Conseil Supérieur de l'Assistance Publique, the Conseil Supérieur de Travail, and the Conseil Supérieur de l'Enseignement Technique. In 1901 he was President of the Société Internationale pour l'Etude des Questions d'Assistance; last year he acted as President of the Société de Médecine Publique et de Génie Public Sanitaire, and is now President of the Comité des Habitations à Bon Marché de la Seine and President of the Ligue contre la Mortalité Infantile. M. Strauss is the editor of the *Revue Philanthropique*. He has written "Paris Ignoré"; "l'Enfance Malheureuse"; "Dépopulation et Puériculture"; "Pauvre et Mendiants"; "La Croisade Sanitare"; in collaboration with M. Fillassier, "La loi sur la Santé Publique"; and in collaboration with M. Bauez, "Les Habitations à Bon Marché en Allemagne."

The present article is from *Public Works*, London, England.



Decree of 1884. New decree.

Fig. 1. SECTION OF PUBLIC STREETS.

The shaded parts marked A show what the new decree takes away from the height of houses in narrow streets. The shaded parts lettered B show what the new decree adds to the height of houses in broad streets.

even of concessions as to the projections. Paris was not only menaced with the danger of becoming uniform and commonplace, but also with seeing its breathing spaces—the green and healthy gardens which the majority of the large European towns manage to preserve in front of the private houses—narrowed day by day.

In the interests of architectural beauty and to allow more variety in the frontages, the revision of the statute of 1882 concerning the building projections was at first mooted and finally brought about.

The principles which have been adopted in drawing up the decree of 1902 concerning permanent projections are stated as follows in the report of M. Louis Bonnier:—

1. The projections allowable in front of the building line should be proportional to the legal width of the streets.
2. These projections should be enclosed within very simple lines, in which the architects should be at full liberty to work, without a particular projection being specified for a particular ornamentation within these limits.
3. The decree should not be retrospective; that is to say, should be drawn up so that the minimum of the projection allowable must not take away any of the advantages allowed to the owners of houses in the narrow streets by the decree of 1882.
4. It should favor the development of the sky-line; that is to say, authorize new and important projections in the ornamental part of the roofs.
5. It should regulate corbelling, which was prohibited by the decree of 1882, in the hope that this style of architecture will contribute to the decoration of the public streets.
6. It should prevent, as far as possible, this corbelling from hiding from the neighbors the lateral view of the street.
7. It should neither recommend nor forbid any materials or any method of using them.

As regards movable projections, the decree reclassifies them and simplifies the regulations concerning them, as in the case of the permanent projections. It puts the height of projections interfering with the traffic at 3 metres (about 10 ft.) above the footpath; and in case of the narrow streets it increases to 80 centimetres (about 32 inches) the allowable distance of the movable projections from the border of the footpath, the distance now being about 20 inches (50 centimetres).

II.—In endeavoring to break the monotony of the façades the Paris administration were forced to remodel not less thoroughly the building regulations, especially those which governed the height of buildings.

The decree of 1884 had a grave defect, forcibly pointed out by M. Boileau. It failed to specify the proportions to be observed between the width of the streets and the height of the buildings which might be constructed in them. In a street about two-fifths of an inch (1 centimetre) less in width than another in which six-story houses were permissible, the builder was compelled to stop at the fifth story, without being permitted to modify the height of any of the stories from floor to ceiling.

The streets were divided into four categories only. In a street the width of which was not more than 7.80 metres

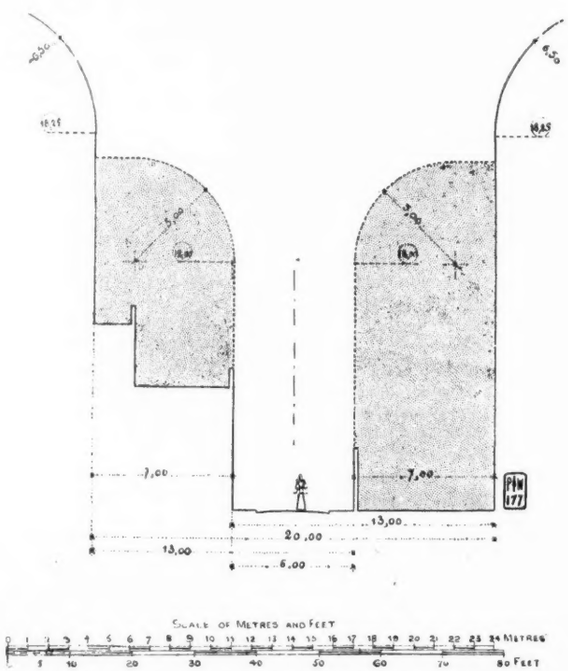


Fig. 2. NARROW STREETS.

Example of a street only 6 metres (19½ ft.) across, which can, under Clause 4 of the new decree, be widened without expropriation. The frontage allowed by the decree of 1884 is shown by the shaded parts.

(about 26 ft.) the allowable height of the front of the house was 12 metres (just over 39 ft.). This rose to 15 metres (49 ft.) in streets between 7.80 metres and 9.74 metres (26 to 32 ft.) in width; to 18 metres (59 ft.) in streets from 9.74 metres to 20 metres (32 to 65½ ft.) wide; and to 20 metres in the case of streets 20 metres wide and above.

Everywhere—in London, Rome, Brussels—the proportions were less rudimentary than in Paris. M. Bonnier brought forward, moreover, an argument from the sanitary point of view. He deplored the fact that Paris should allow houses 18 metres (59 ft.) high in streets of an average width of 12 metres (39 ft.), whereas Frankfort in this case restricted the height to 14 metres (48 ft.), and Berlin and St. Petersburg to 12 metres (39 ft.). London, on the other hand, approached the excessive heights of Rome and Lisbon in permitting buildings 24 metres (79 ft.) high in such streets.

The guiding principle adopted in the decree of August 13, 1902, is to proportion the elevation of the buildings to the width of the street. Henceforth in streets less than 12 metres (39 ft.) wide the houses must not exceed 6 metres (19½ ft.) in height, plus the legal width of the road.

In streets 12 metres (39 ft.) wide and above, the height must not exceed 18 metres (59 ft.), plus one-quarter the width of the street above 12 metres, and in any case the height must not be more than 20 metres (65½ ft.) above the pavement. In calculating the allowable height each fraction of a metre of roadway is to be taken as one metre.

When the road slopes, the frontage of the adjacent buildings is divided into sections of not more than 30 metres (say 98 ft.), and the allowable height is calculated from the center point of each section. If the builder puts up detached houses, the height of each is calculated by the rules already given.

The necessity was also felt of relaxing the stringent regulations as to the roofs of buildings. The old decree enacted that the radius of curvature of the roof should be equal to half the width of the street, with a minimum of 5 metres (16.4 ft.), and a miximum of 8½ metres (say 28 ft.). In all cases the hood of the garret windows or bull's-eyes was not to project more than 50 centimetres (20 ins.) beyond the defined limits. This contributed also to the monotonous effect of the sky-line, already referred to.

The new regulations increased the radius of curvature of the roof, making 6 metres the minimum and 10 metres the maximum. The builders henceforth will have more scope and latitude, and there can only be a gain in architectural effect by thus allowing more variety in the higher parts of the buildings. As M. Cherioux observed in his report to the Municipal Council, the roofs, instead of being imprisoned in almost useless semicircles, will be bounded on each side by the arc of a circle of 45 degrees, and a rectilineal tangent drawn at the extremity of this arc.

The decree of 1902 contains an ingenious arrangement concerning the building line. A builder henceforth may in a narrow street put back the whole or part of his façade, and in exchange will be allowed to increase the height of the structure. If a builder on the opposite side also puts his building back, the public way will thus be widened without expense to the city, and in a simple and equitable manner. The old regulations did not permit this; they imposed an ever steadfast building-line, as M. Bonnier says.

Another very important innovation is the regulation concerning courts. Formerly the height of the buildings bordering the court-yard was regulated in the same manner as that of houses in a street. The average width of the court served as the initial figure of the calculation, and inhabited apartments in a triangular court frequently looked out upon a high dead wall.

The decree of 1902 substituted for this rule a regulation taking into consideration the direct view calculated from a

Fig. 3.

Street of 6 metres (19½ ft.) wide Decree of 1884.

line drawn at right angles from the windows to the opposite wall. Moreover, the minimum surface of the inner spaces of the houses has been taken into calculation. The court-yards from which rooms inhabited day and night receive light and air must have an area of 30 sq. metres (323 sq. ft.) at least. Where the living rooms are simply kitchens the minimum area may be reduced to 15 sq. metres (say 160 sq. ft.). The back courts lighting and ventilating rooms not used as living rooms may have an area of 8 sq. metres (86 sq. ft.).

The direct line of sight looking straight across from rooms inhabited day and night must not be less than as follows:—

Fig. 4.

Street of 6 metres. Decree of 1902.

Minimum Area of the Court.				Direct Line of Sight (Minimum).			
30 sq. metres	(323 sq. ft.)	.....		4 metres	(13 ft. 2 ins.)		
33·33 "	(359 ")	.....		4·33 "	(14 "	3 "	)
36.66 "	(395 ")	.....		4.66 "	(15 "	3 "	)
40 "	(431 ")	.....		5 "	(16 "	5 "	)
43·33 "	(466 ")	.....		5·33 "	(17 "	6 "	)
46.66 "	(502 ")	.....		5.66 "	(18 "	7 "	)
50 "	(538 ")	.....		6 "	(19 "	8 "	)
53·33 "	(574 ")	.....		6·33 "	(20 "	9 "	)
56.66 "	(610 ")	.....		6.66 "	(21 "	10 "	)

In the case of detached houses separated by a wall, the direct line of sight of the dwelling rooms must be 5 metres (say 16½ ft.). The Conseil d'Etate did not think it advisable to extend this regulation to the private streets. The sanitary law of February 17, 1902, which only came into force at the beginning of this year, having, however, extended and defined the powers of the municipalities, the new by-law framed by the city of Paris completes the regulations of the decree of April 13, 1902, concerning the heights and projections of buildings.

This by-law makes the decree of August 13, 1902, some of the clauses of which have been revised with a view to clearness, apply to private roads of every kind, whether thoroughfares or blind alleys. The minimum line of sight from the living-rooms or kitchens of houses looking on to private roads must be 6 metres (19½ ft.).

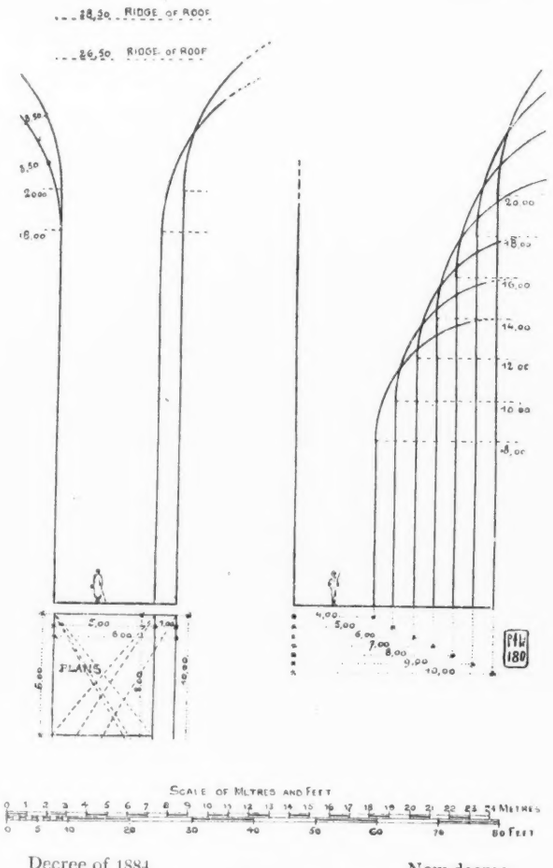
The two conditions of area and line of sight must invariably be fulfilled in the case of courts lighting living rooms or merely kitchens.

A complimentary clause has been added in order to deal with courts roofed in with glass, which are too often constructed and kept in an unsanitary condition. A ventilating shaft must be provided, of such dimensions that the statutory minimum area of courts for lighting and aërating living-rooms shall not be diminished by the glass roof.

A fundamental distinction will henceforth be made between cellars properly so called and rooms below the ground level inhabited during the day. The regulations of Paris hitherto had not recognized the distinction made between cellars and basement rooms in London, Berlin, Vienna and other cities. The regulations as to cellars remain as before, but inhabited lower rooms will be more rigorously fenced in with regulations. They must be dry and well ventilated.

The decree of 1884 limited the maximum number of stories to seven, the ground floor not being counted. This limitation disappears with the decree of 1902, but the minimum height of each story is defined.

In all buildings, of whatever nature, adjoining public or private roads or court-yards, the height of the ground floor rooms and that of the floor immediately above must not be less than 2.80 metres (say 9¼ ft.) from floor to ceiling. The height of the basement rooms and of the stories above the first floor must not be less than 2.60 metres (say 8½ ft.).



Decree of 1884. New decree.

Fig. 5.

Sections of court-yards giving light and air to living-rooms. The sections show the minimum open space in front of any window and the maximum of height.

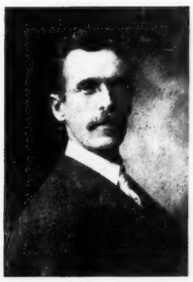
In the top room of the house the height is measured at the highest point, but every attic with a sloping roof must have at least 2 sq. metres (21½ sq. ft.) of horizontal ceiling,

(To be concluded in April)

BRICK PAVEMENTS FOR VILLAGES*

How a New York Village Builds Its Streets—Practical Methods Produce Excellent Results

By LeGrand Brown, C. E.



LeGrand Brown, C.E.
Village Engineer
Canandaigua, N. Y.

Canandaigua, N. Y., having a population of about eight thousand, is expending approximately $400,000 in street improvements. Of a total of 27 miles, 9.1 miles are, or are under contract to be, improved, there being 4.7 miles of brick, 1.1 miles of macadam with curb, and 3.3 miles of macadam without curbs. The brick pavement consists of about sixty thousand square yards of Mack repressed block, thirty-three thousand yards of Metropolitan block and three thousand yards of Porter-McMahon block. To make these improvements, bonds were issued by the village for one-half of the cost of the improvement, the other half being assessed upon the property abutting upon the street improved. The property owners have the option of paying the tax at once, or in five equal annual payments with 5 per cent. interest.

The width between curbs as residence streets varies from twenty to thirty feet; twenty-four feet being found a very satisfactory width, it being considered better policy to improve more miles of street rather than a shorter length of greater width. The main street, 132 feet in width, was, for 1600 feet in the business portion, paved with Mack block eighty-two feet between curbs, with sidewalks twenty-five feet in width. The remainder of the street (7,500 feet), forty feet between curbs. This street has one street car track in the center.

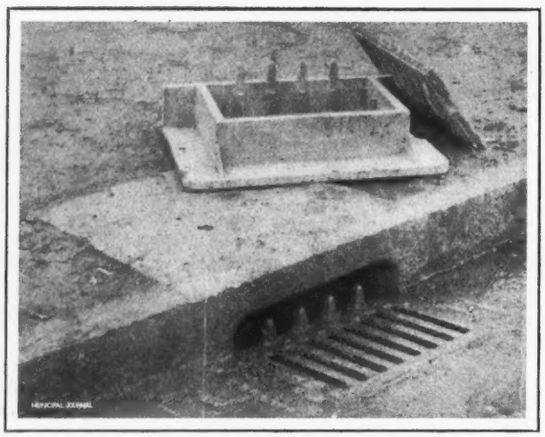
The crown is generally six inches on the narrow portion; on the wide portion it varies owing to the curbs on opposite sides being not only of different elevations, but also on different grades at certain points. The difference of elevation at one place is thirty inches; at this point, however, the crown is so located as to throw two-thirds of the drainage to the low side. On a number of streets this same condition exists, but to a much less degree.

The surface water from the pavements is carried off by a system of vitrified pipe sewers, independent of the sanitary sewers, twelve to twenty-four inches in diameter laid in a bed of gravel concrete. In most cases the sewers are placed four feet back of the curb, as little being under the pavement as possible. Catch basins are located 150 to 200 feet apart, and where there are car tracks, catch basins are placed between the rails, slightly depressed below to catch the water, but not low enough to be objectionable to driving over.

RANSOME CONCRETE MIXER AT WORK ON CANANDAIGUA STREETS

The catch basin wells are constructed with brick walls and are generally three and one-half feet deep, twenty by thirty-six inches extending fourteen inches into the street; the opening, with grate removed, being fourteen by twenty

* This is the first of a series of articles on street pavements in small towns. Others will follow in near numbers of The Municipal Journal and will be written by practical engineers, usually the men in charge of the local work. Mr. LeGrand Brown, the author of this article, while acting as the village engineer of Canandaigua has an extensive business as a consulting engineer and is a man of broad experience. He was Chief Engineer of the Rochester Street Railway for ten years.—[Editor.



SEWER CATCH BASIN AND GRATE, USED IN CANANDAIGUA, N. Y.

inches. The stone which covers that portion back of the curb line being twenty-four by thirty by 7 inches, there being four inches cut away in front to allow the water to flow into the basin in case the grate becomes clogged. There are four cast iron points, cast with the frame which projects two and one-half inches in front of this opening to prevent sticks or rubbish from being washed into the basin. The stone top forms the curb and, being seven inches deep, allows a depression at the catch basin; the usual depth of gutter being six inches, and about two feet on the down grade side of the basin; the depth of gutter is generally four and one-half to five inches, this forming sufficient depression to catch the surface water.

The catch basin grates are supported by lugs instead of the usual form of construction. The cross-sections show the construction of the different kinds of pavements.

A three-inch porous drain tile was laid in gravel below and back of the curbs, connected to the catch basins, all joints in the tile being covered with canvas or burlap to exclude the sand. In one macadam street a porous tile drain was laid under the center of the street and the trench filled to sub-grade with small stone. This underdraining is a great benefit to the pavement even on a brick paved street.

Much of the grading was done by machinery, a Case traction engine being used to plow, and draw the combined grader and loader (made by the National Drill & Mfg. Co., of Chicago). This machine frequently excavates and loads on wagons, 600 cubic yards per day. Under favorable conditions it could work at a greater advantage. After excavating the street and setting the Medina stone curbs, the sub-grade was thoroughly rolled with a Buffalo-Pitts 12-ton roller, this roller being frequently used to draw the plow.

A Portland cement and gravel concrete was used under about one-third of the brick pavement, natural cement and broken stone concrete under the remainder. This layer of concrete was six inches in thickness.

Most of the gravel was screened with a climax elevator and rotary screen, made by the Climax Road Machine Co., Marathon, N. Y. The mixture for gravel concrete was 1-2-4½; for broken stone concrete, 1-3-7.

A portion of the concrete was laid nights, a Rush acetylene gas machine being used to furnish light in addition to the electric lights.

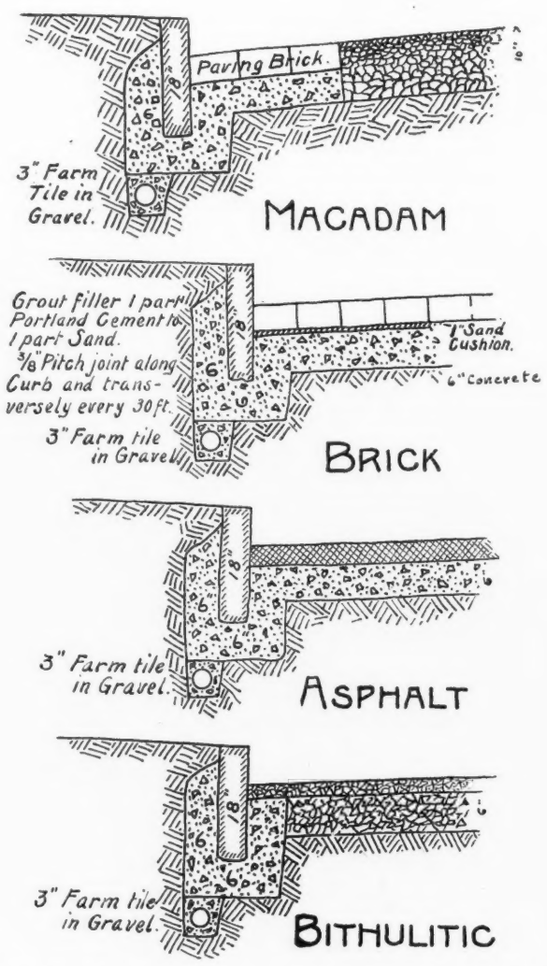
The gas generator was mounted upon a light wagon, the pipe laid on one side of the street, upon the top of the curb, and the burners placed about five feet above the curb. This lighting plant was easily moved and found to be very satisfactory.

All the concrete was mixed by Ransom rotary mixers, operated by steam, one of the mixers being self-propelled, the others requiring horses to move them. As a rule, the concrete was mixed wet, about 20 gallons of water being required per cubic yard (including that required by the engine).

It was found that the sand cushion under the brick should not be less than one and one-half inches thick before tamping or rolling, for if a slight unevenness or projection of the concrete allowed a brick to rest directly upon it, there was a liability of the brick eventually breaking or becoming loose, should the grouting be imperfect or not well down around the brick.

After the sand cushion was carefully prepared with a template, the paving brick was laid, with a thin wooden strip or common lath along the curb and about every thirty feet across the street to allow for expansion joints. The bricks were then examined. Some of them turned to get the best side up and those not complying with the specifications removed and replaced with good ones.

Instead of tamping the brick, a five-ton horse roller was



SECTIONAL VIEW OF VARIOUS FORMS OF PAVEMENTS TO BE USED IN CANANDAIGUA, N. Y.—ALSO SHOWING USE OF DRAINAGE TILE AT BASE OF CURB

used, hand tamping being done only in driveways and around catch basins.

The rolling was done longitudinally of the street. The roller was manufactured by the Acme Road Machinery Co., Frankfort, N. Y., and so arranged that the pole and seat turn upon a pivot, thus allowing the team to reverse without turning the roller, which would displace and break the corners from the brick. A more even surface was obtained by rolling than by hand tamping as well as being a saving of time and labor.

MACK BLOCK PAVEMENT LAID IN CANANDAIGUA, N. Y.

Great care was used in grouting the pavement, as we consider that the life of the pavement depends more upon this being properly done than any other part of the work. After removing the strips from the expansion joints, filling them about one-half full of clean paving sand, and pouring full of hot paving pitch, the pavement was cleaned and sprinkled before grouting. A clean, fine and sharp sand was found absolutely indispensable to make a proper grout. This was mixed in small quantities in a box measuring about three by four feet, one foot in depth, the bottom on one end being beveled.

This grout was composed of one part of Portland cement to one part of sand, mixed quickly and very thin, then the box turned upon end, and the grout quickly brushed into the joints with rattan brooms. The next grouting was applied generally within a couple of hours, it being of greater consistency than the first, and likewise well brushed in. In many cases a third coat of grout was applied.

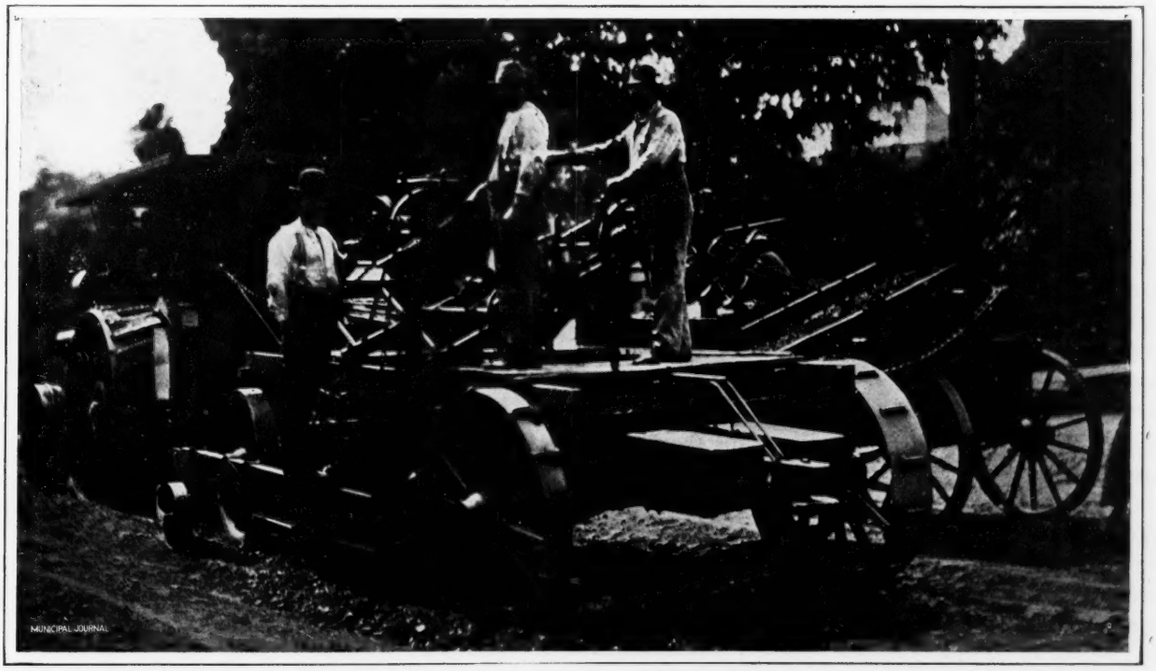
Rattan brooms were found much more satisfactory for applying the grout than anything else tried.

Thirteen feet radius curved curb was used at street corners, and four feet radius at driveways which were generally eight feet wide and paved back four feet from the curb line.

On one street a concrete bridge of twenty feet was constructed in place of an old wooden structure and the brick pavement carried over it.

In macadam streets, a small amount of combined concrete curb and gutter has been laid, but the Medina stone curb with a brick gutter two feet in width has been found much more satisfactory. The brick being laid on a four- to six-inch concrete foundation, with one inch sand cushion and filled with Portland cement grout.

During the progress of the work all material was carefully inspected and tested, cement tests being made daily.



NATIONAL ELEVATING GRADER AND WAGON LOADER DRAWN BY A CASE TRACTION ENGINE—PREPARING SUB-GRADE FOR BRICK PAVEMENT, CANANDAIGUA, N. Y.

BRITISH PUBLIC HOUSE TRUST

Americans Are Liberal Subscribers to the Funds of the Central Association—The Enterprise Has Passed the Experimental Stage

An enterprise in Great Britain which may result in important changes in the habits of the people and in the conduct of a vast business is styled the Central Public House Trust Association.

The public house of Great Britain is essentially the same as the saloon of the United States. There is the marked difference, however, that in Great Britain women are almost as numerous as men at the drinking bars, and that the bartenders are usually young women. It is argued for the barmaids that their presence tends to preserve order, but no defense of female dram drinking is attempted.

The public house trust is a trust in the interest of the community and not for private profit. Its object is to reduce intemperance by changing the ordinary methods of conducting public houses.

The origin of the enterprise dates back to 1877, when Rev. Osbert Mordaunt, on his appointment to a parish in Warwickshire, found himself the trustee of a village inn left by a predecessor in trust for the parish. He decided to run the inn according to what is known as the "Gothenburg" system, a system which, it is claimed, transformed Norway from the most drunken to the most sober country in Europe—the main principles adopted being that the liquor should be of good quality and the manager should have no interest in increasing its sale. This experiment was followed by others, notably that at Elan Valley, where the Birmingham waterworks committee established a canteen for the use of its workmen, which led to the formation by the Bishop of Chester and Colonel Craufurd, in 1896, of the People's Refreshment House Association. Its aim was "to give wider facilities for the adoption of the system of public house management, with limited profits, already successfully at work in various parts of the United Kingdom."

The successful experiments of the People's Refreshment House Association led Lord Grey, in 1901, to form, purely as a propagandist society, the Central Public House Trust Association, for the purpose of inaugurating a public house trust company in every county, the county as a unit being an essential feature of the scheme. Beginning with Northumberland, Kent, Durham, and North Yorkshire, local trusts have now been established in every county in England except Leicestershire, Oxfordshire, Berkshire, and Buckinghamshire. Trusts have also been formed in Ulster (Ireland) and in South Wales. In Scotland, where the movement has established itself strongly and a number of trust companies are working, a Scottish Central Association has been formed this year to spread trust principles and to regulate public opinion with the view of arriving at the best form of public management.

At the present time about one hundred and fifty public houses are under trust management. This number is likely to be largely increased in the near future, as landowners are more and more appreciating the advantages to a village or neighborhood of trust management and are offering their public houses to the local trusts as the present tenacy agreements expire.

COMPLETED BRICK PAVEMENT, CANANDAIGUA, N. Y.—*See page 107*

The underlying principles enforced by the Public House Trust Association are as follows:

The general arrangement and management of the house shall be on the lines of a house of refreshment, instead of a mere drinking bar.

Food and a good variety of nonintoxicant drinks shall be as easily accessible to customers as beer and spirits.

The licensing laws enacted by Parliament for the regulation of public houses and the promotion of temperance shall be most strictly carried out in every particular.

A holder of a license is in a sense a servant of the public, and he must study the comfort, well-being, and health of his customers; his house must therefore be scrupulously clean, and the rooms most used by the public must be comfortably arranged, well warmed in winter, and well ventilated.

The manager of the house receives a fixed salary, with

inducements to push the trade in food and nonintoxicants, but with no interest in the sale of alcoholics.

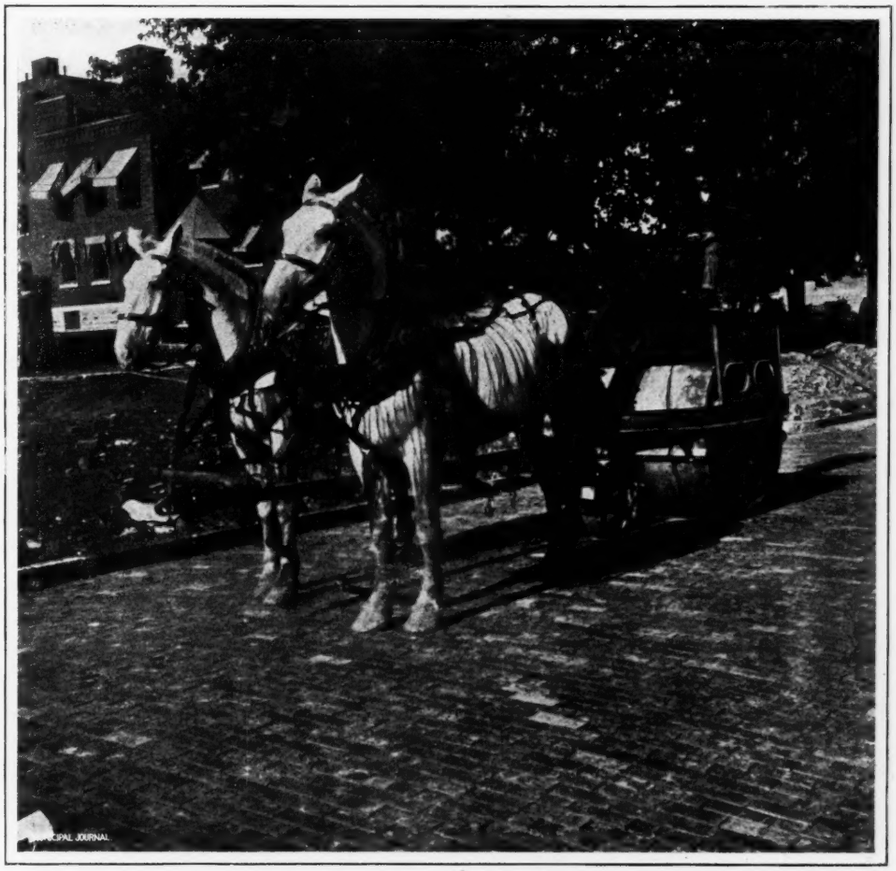
A system of inspection guards against abuses and mismanagement. An inspector visits the house without previous notice, takes samples of the liquors, examines the quality of the food and drink, and goes thoroughly over the premises.

It is not the purpose to establish new public houses, but only to acquire such as are already established, except in the case of new licenses which the authorities intend granting—these the association will try to secure. It may, however, open new refreshment rooms for the sale of food and nonintoxicants.

The capital is raised by subscriptions for shares in the trust companies formed in the various counties. The total subscribed capital at present amounts to $1,500,000. The company in each county is governed by a council, of which the lord lieutenant of the county is ex-officio the head, and by trustees, directors, and other officers, among whom are usually the most distinguished men of the country. The total number of subscribing members is now nearly 1,000. The shares are allotted on such conditions as to give the council a voting power, enabling it to prevent the trust from getting into the control of persons who might use it for their private purposes. The maximum dividend payable to the shareholders is 5 per cent., the surplus profits being devoted to public objects.

The net profits of the public houses in the United Kingdom last year are estimated at about $100,000,000, nearly $2.50 per head of the population. The profit of an average public house is indicated by the fact that several trust houses last year distributed to objects of public benefit surplus profits ranging from $1,500 to $5,000. These, unlike the ordinary public houses, made special efforts to sell the least profitable things—food and nonalcoholics.

From all parts of the British Isles where trust houses exist come reports of less disorder and drunkenness, decreased use of alcoholics, and a general improvement in the appearance of such resorts and of their patrons.



"ACME" HORSE ROLLER USED ON BRICK STREETS, CANANDAIGUA, N. Y.—*See page 107*

In this county (Nottingham) the trust has sixty-five correspondents, who have volunteered their services, and who advise the secretary of all opportunities of securing public houses now existing. The work was begun here only last year, and the trust does not yet own any houses, though it expects substantial results from the efforts of its correspondents. A great obstacle in the way, existing as well in all parts of Great Britain, is the system of "tied" houses—those owned or financed by breweries. This system has been in existence in a sporadic way for the past fifty years, but latterly it has grown to enormous dimensions, owing partly to home brewing having declined, but mainly to the conversion of most of the large breweries into limited companies. An article in the Quarterly Review describing the evolution of the "tied" system has special interest not only because of its relation to the public house trust, but also because the subject is now vigorously discussed in con-

nection with the licensing bill before the present session of Parliament. The article says:

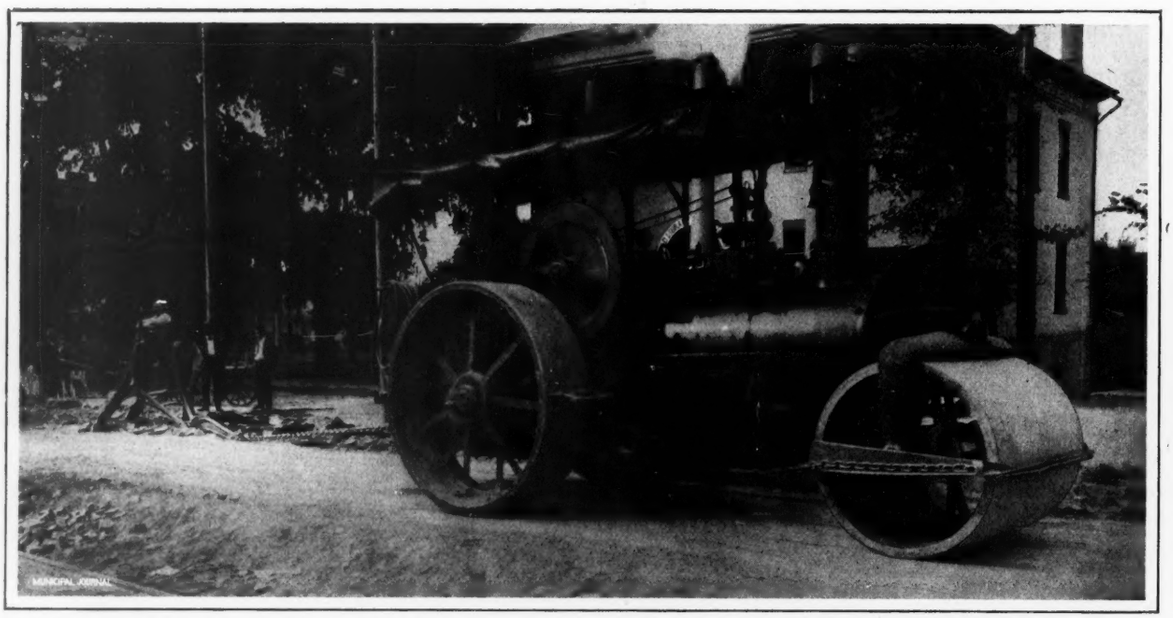
About twenty years ago the partners in the great concern of Guinness & Co. (makers of stout) decided to offer their business to the public. No sooner was the prospectus issued than the phenomenal success of the venture was apparent. The shares were subscribed for many times over, and afterwards rose in value to something like three times the issue price. The other large breweries in the country were not long in adopting the same policy, and one after another their undertakings were sold to the public at enormous premiums. The directors in each case found themselves with a large margin of capital on their hands, in excess of what could be profitably employed in the business proper, for which it was necessary to find an outlet that would bring increased trade and secure the larger profits required to provide a dividend on the larger capital. The outlet was found in the purchase of public houses in which to sell the liquor brewed by the company—an expedient which provided a profitable investment for capital as well as a means of increasing the trade. The competition between rival companies to secure houses became acute, and the prices of licensed houses were forced up to extraordinarily inflated figures, of which the following, among innumerable instances, will serve as a fair illustration: The Crooked Billet, a fully licensed house in Newcastle-on-Tyne, was put up to auction in 1896. The first bid was for £10,000 [$48,665], and it was knocked down for £15,800 [over $76,801]. The house forty years earlier had been sold for £900 [$4,380], and no important structural improvements had been made in the interval.

The Review writer concludes that such conditions increase the temptation to push sales of beer by even illegitimate means, as a brewery, having paid a high price for a house, naturally expects the tenant to sell enough beer to return a dividend on the watered capital. It is charged, besides, that, having secured an outlet for their product, brewers pay less attention to quality and careful making than when their beer competed in a free market. The system appears to be condemned universally, except by those directly interested in its profits.

At present nearly 80 per cent. of the English public houses are "tied." How to detach these is the most serious problem confronting the trust. It never expects to gain control of all the public houses in the United Kingdom, but its work will be imperfect unless it can control more than the proportion of houses now outside the "tied" system.

It should be explained that the public house trust is entirely distinct from any of the "temperance" societies of this country, which generally favor policies looking to the complete extinction of the liquor traffic.

Among the members and liberal subscribers to the funds of the central association are a number of Americans, widely known for their interest in philanthropic works.



BUFFALO PITTS ROAD ROLLER USED FOR PLOWING, PREPARING SUB-GRADE FOR BRICK PAVEMENTS, CANANDAIGUA, N. Y. —*See page 107*

WOOD STAVE CONDUIT

New Conduit for Atlantic City Water Supply—Construction Described by the Chief Engineer

By Kenneth Allen

WESTERN engineers have demonstrated the adaptability of wood-stave construction for water pipes carrying all but very high pressures The indestructibility of wood when kept apart from the air was demonstrated in specimens from Switzerland on exhibition at St. Louis which had been under water for centuries, and the essential preservative is to keep the wood thoroughly water soaked.

Of the wood-stave conduit for the water supply of Atlantic City, N. J., Kenneth Allen, engineer and superintendent of the plant, said, in a paper read before the New England Water Works Association:

The department was fortunate enough to secure bonds for replacing the canal with a closed conduit, and after conservative estimates it was decided to construct this of wood staves. The following are some of the principal data employed in the design:

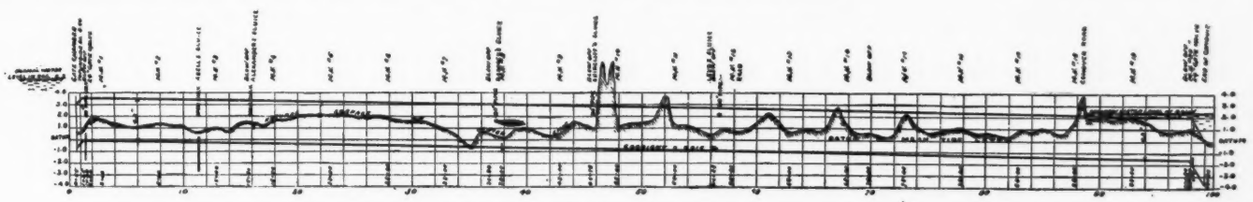


FIG. 1. PROFILE OF WOOD-STAVE CONDUIT

DATA	
Normal elevation of water surface in reservoir above mean tide...	+5.20
Ordinary elevation of water surface in basin, from.....	+2.50 to +3.50
Diameter of conduit	42 in.

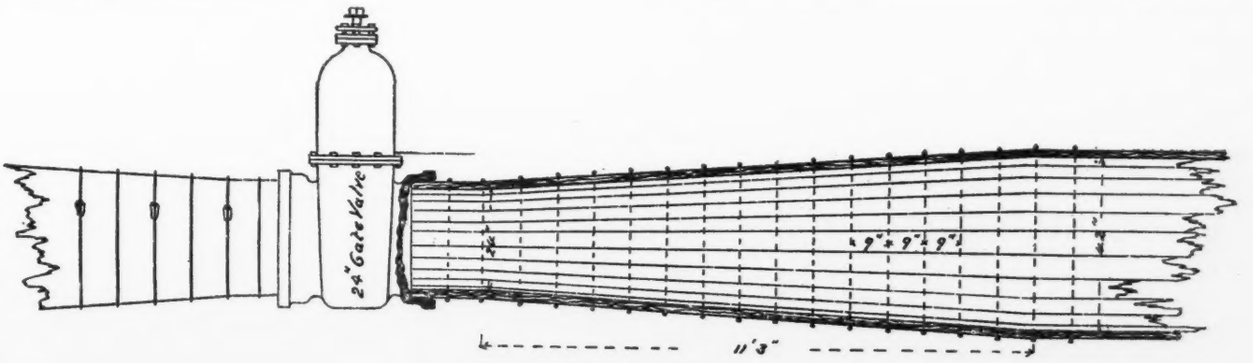


FIG. 2. VALVE AND REDUCER

Since 1892 the main supply for Atlantic City has been brought from the storage reservoir to a small reservoir by an open ditch or canal. When in good condition this canal would deliver about 8,000,000 gallons per day, but owing to erosion and deposits and the rapid growth of aquatic vegetation, its capacity at times in summer was probably not over five or six million gallons per day.

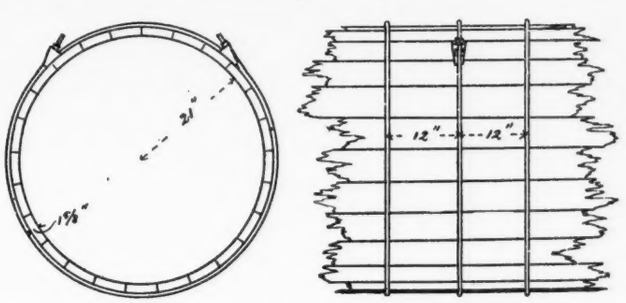


FIG. 3. SECTION OF CONDUIT, SHOWING METHOD OF CONSTRUCTION

Total length of tangents	8,610.2 ft.
Length of conduit in 9° curves..	238.3 ft.
Length of conduit in 24° curves..	958.9 ft.
Total length of conduit.....	9,807.4 ft.
Gradient	0.016%
Minimum capacity estimated.....	8,000,000 gals. per day
Maximum capacity estimated....	12,000,000 gals. per day

It was decided to locate the conduit as far as possible in the bed of the old canal, partly to facilitate work, partly because this was the center of the right-of-way, and also in order to permit the water supply to be utilized, in case of accident to the artesian well supply or of any unusual demand on account of fire or otherwise. For the same reason it was concluded to construct the pipe in the trench instead of lowering it from a higher level.

Fig. 1 is a profile on the line of the conduit.

It was assumed that material excavated would all be used in back filling, the volume of this being calculated from

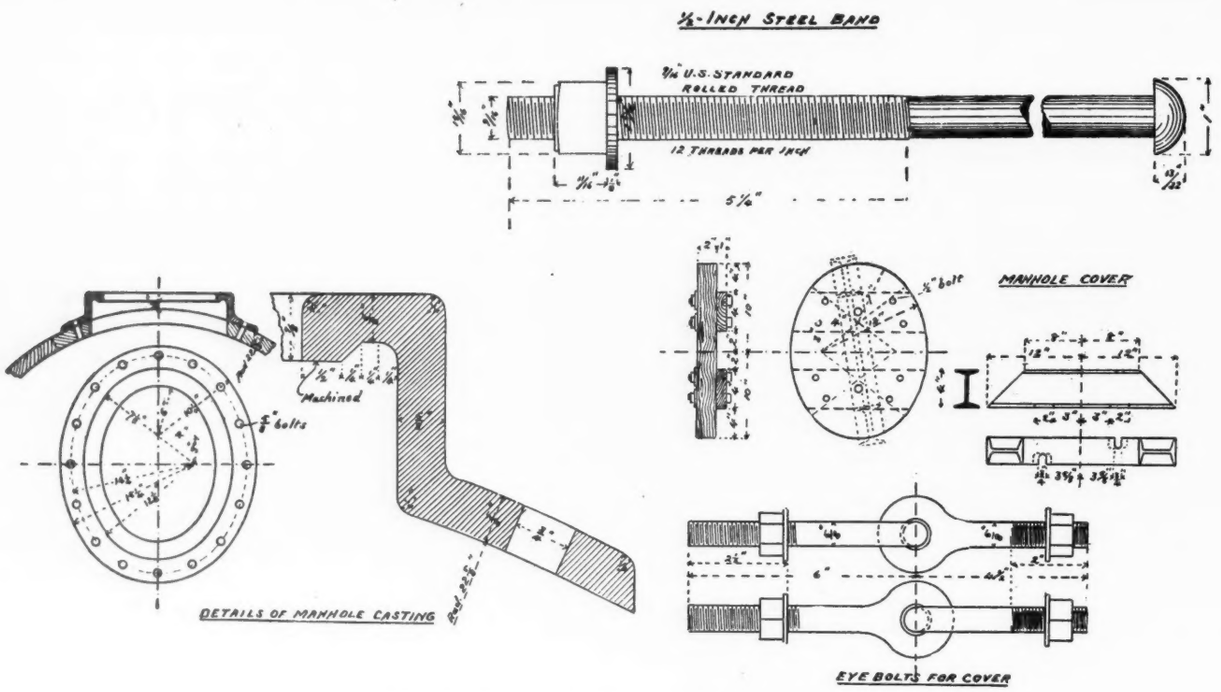


FIG. 4. DETAILS OF BANDS AND MANHOLES

cross-sections taken not over one hundred feet apart, and the specifications called for a lump sum bid for the earthwork required for the conduit based on the volume of back fill (estimated at 7,850 cubic yards), a price per cubic yard for excavation for foundations of gate chamber and culverts, and 30 cents per cubic yard for any extra excavation that might be required.

The method of construction is shown in Fig. 3.

The spacing of bands 12 inches apart was determined by the formula $d = \frac{S}{PR + et}$ in which

S = safe working strength of ½-inch band in pounds ..... = 3,000
P = maximum static pressure in conduit in pounds per sq. in..... = 4
d = spacing in inches .....
R = inside radius of pipe in inches..... = 21
e = swelling force of wood per square inch in pounds ..... = 100
t = thickness of staves in inches..... = 1.625

On other than straight cylindrical pipe the spacing was reduced to nine inches.

The following extracts from specifications, together with the details reproduced in Figs. 2 and 6, will indicate the general character of the work:

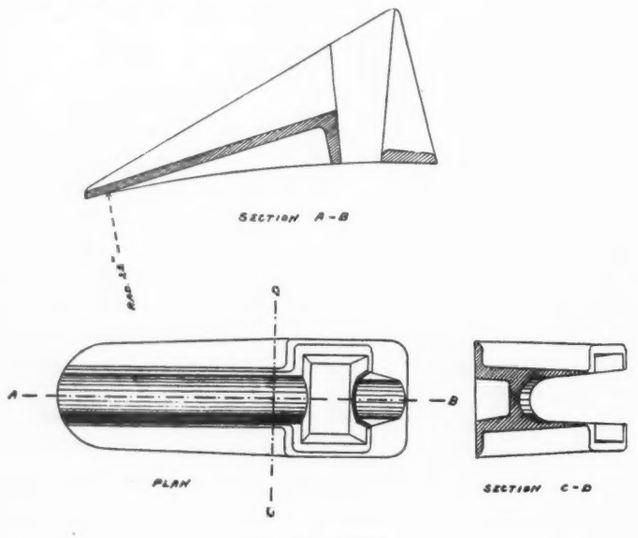


FIG. 5. SADDLE

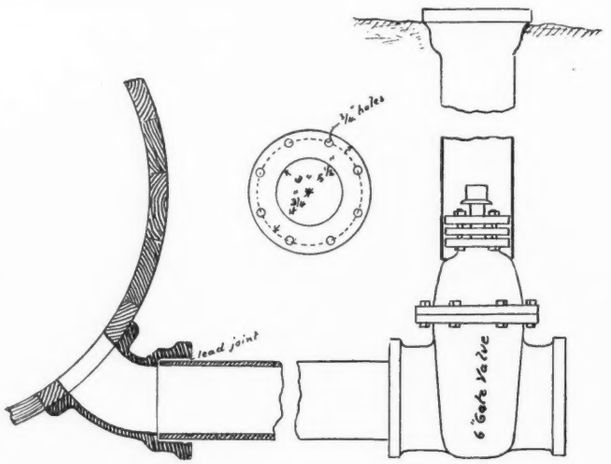


FIG. 6. BLOW-OFF

"*Staves.* The quality of the lumber used for staves is considered of prime importance and will be subject to rigid inspection. Staves of material or shape not conforming in every respect with the intent of these specifications will be rejected and shall be at once replaced by the contractor with staves conforming therewith.

"The staves shall be either of California red wood, long leaf yellow pine, southern cypress, or of Oregon, Washington or Douglass fir, and bidders are asked to specify on which of these their proposal is based. The staves shall be

WOOD STAVE CONDUIT—COATING BANDS

made from perfectly clear, first-quality lumber, as well seasoned as the market affords, perfectly sound and free from sap, spongy grain, knots, shakes, dry rot, pitch seams, cracks, or other defects that may impair its strength or durability. The stave lumber shall be placed on sticks immediately after being sawed, so that the air may freely circulate between and around it, and shall remain on said sticks until manufactured into staves. Before the manufacture of staves is commenced, templates must be submitted to the engineer for his approval."

The lumber used was Washington fir, and was of exceptionally fine quality, so that there was practically no loss from culling. The minimum length allowed was ten feet. They were cut from 2-inch by 6-inch lumber and measured 1 9/16 inch in thickness and 5⅜ inches on the inner surface. The ends were square and contained a kerf to receive a 1⅜-inch by 5¾-inch tongue of No. 12 gage iron.

"*Bands.* The bands shall be of homogeneous 'mild' steel having a tensile strength of from 55,000 to 65,000 pounds per square inch of section; an elastic limit of at least 60 per cent. of tensile strength; an elongation in eight inches of not less than 25 per cent.; a reduction of area at point of rupture of at least 45 per cent., and shall be capable when cold of being bent back flat upon itself without showing signs of fracture.

"The threads at end of bands may be pressed or the rods upset, and the threads cut, but the ends shall be stronger than the body of the band, and this shall be proven from records of tests to be made by a reputable firm of inspectors, certified copies of which shall be furnished the engineer.

"Especial care shall be taken to avoid injury to the threads in shipping and handling the bands.

"All bands shall be provided with necessary nuts and washers; the nuts shall be of such length, from face to face, and shall fit so close to threads as to secure a resistance to stripping at least equal to the tensile strength of the body of the band." Details of the bands are shown in Fig. 4, and the saddles in Fig. 5.

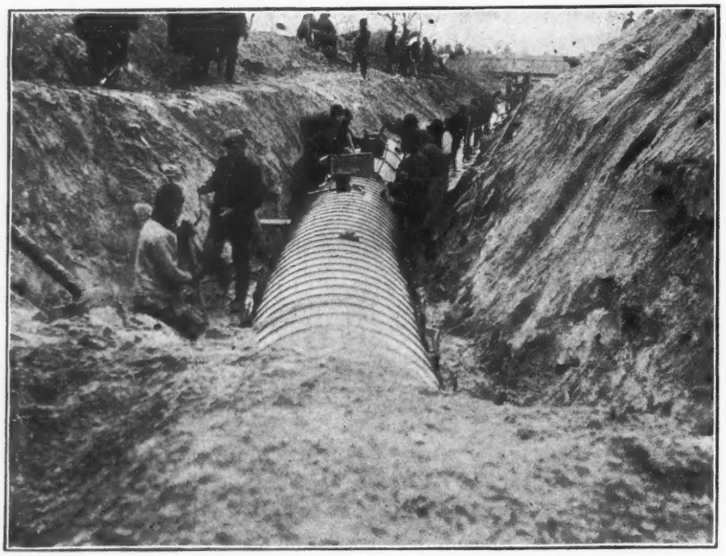
"*Preparation of the Bands.* The bands, nuts washers and saddles shall be thoroughly cleaned of all scale, rust, oil, dirt, etc., and the bands bent around a bending table to fit the exterior surface of the pipe."

After being cleaned they shall be coated in the field by being dipped in hot mineral rubber or other material equally good, to be approved by the engineer, after having been heated to 400° F. This coating must adhere firmly to the metal and must not flow at a temperature of 150° F., nor be brittle at 32° F. It must cover the metal perfectly to a thickness of at least one-fiftieth of an inch. The bands shall then be set aside to allow the coating to properly harden before subsequent handling.

The bands were first bent to the proper radius by winding them about a short cylinder or bending table 38 inches in diameter, or about seven inches less than the diameter of the band required. After bending they were tied by wire in bunches of five for coating.

The question of coating of the bands was deemed all-important, as being the chief element in determining the life of the conduit. It was believed that considerable abrasion would be inevitable in transportation and that if coated after delivery the danger from rust would be very

WOOD STAVE CONDUIT—LAYING THE INVERT



WOOD STAVE CONDUIT—CONSTRUCTION ON CURVE

small. It was found impracticable in the cold winter weather to maintain a given temperature in the kettle. The condition of the coating depended quite as much on the temperature of the band when immersed. After a few trials the time for heating the bands to secure the best results was determined and adhered to until a change of temperature of bands, coating, or outer air required a change: it varied from 2½ to 5 minutes and averaged about 3 minutes. After dipping, the bands were hung up, when the coating stiffened, and they were then piled up for delivery on the work. From 700 to 800 bands bent and coated was a day's work for a foreman and seven men. For this 20 gallons of the mineral rubber was required.

"*Construction of Conduit.* In building the conduit the staves shall be made to break joints and the ends of the two adjoining staves shall in no case be nearer than 18 inches. Proper wooden mallets shall be used in rounding out the pipe, and if required wooden driving bars for making the end joints tight. Bands shall be placed at right angles to the center line of the pipe.

"Since the life of this pipe depends upon the integrity of the coating of the bands, saddles, etc., the contractor and his men shall use every care and precaution to save and keep the coating perfect. The coated bands, saddles, etc., shall be handled so as to prevent as far as possible, any damage to the protective coating, and should the inspector find any on which the coating is imperfect or has been damaged, they shall be rejected and at once removed from the work, and not again brought on the work, unless they have been recoated.

"The coated band shall be cinched and (but only if necessary) hammered very carefully with wooden mallets. The bands, nut, washer and saddle shall receive a heavy coat of mineral rubber field paint or hot mineral rubber. This work shall be done by careful and intelligent workmen, and will be rigidly inspected.

"On each side of the gate valves the conduit shall be conical in shape for a length of eleven feet, the taper being secured by the proper uniform reduction in the width of the staves as shown in the plans, or by the insertion of suitable wedge-shaped pieces.

"After being thoroughly cleaned of all earth, sand, dirt and rust by wire brushes, the castings shall be coated with mineral rubber as already prescribed for the saddles. No acid shall be used in cleaning castings. In case the coating cannot be applied immediately after cleaning, the surface must be preserved by a thorough application of linseed oil.

"Great care must be taken by the contractor not to overstrain the bands during construction, and when filling the pipe with water for the purpose of testing the same. No wrench over 16 inches in length shall be used in cinching."

Trenching was begun on February 4, anl the conduit proper was completed on April 16, 1904.

The material excavated was largely sand; but clay, quicksand, gravel, mud and roots were also encountered in varying quantities. A section of the canal was dammed off and pumped out by one or two portable three-inch gasoline pumps while the trench was excavated and the conduit laid.

The pipe gang consisted of from nine to twelve men. Usually there were, one foreman, two men handiing material, two men driving staves, two men tightening bands, one man rounding out by hammering inside, two men back cinching, one boy painting bands, two men tamping. At times two pipe-laying gangs were employed.

There were also two day men on gasoline pumps, two night men on gasoline pumps, two men on diaphragm pumps, 35 men on back filling.

The sections were finally united by cutting staves to the required length and springing them into place.

Two 24-inch Rennselaer gate valves were placed in the line, one at each end. For eleven feet each side of the valves the conduit was made conical in shape by planing the staves to the proper taper.

Curves were turned by prying over the end of each sec-

WOOD STAVE CONDUIT—OPEN CULVERT

tion as laid to the proper position before back-cinching, holding it in position by struts and back filling until finally secured by back-cinching.

There were several double 30-inch vitrified pipe culverts and two open culverts on the line. The latter were 22 feet between faces of the abutments, but a pier supported the conduit in the center of the span. After the concrete masonry had set, wood collars were placed 12 inches from each abutment and eight inches from each face of the pier on which an outer sheathing of staves was constructed similar to the enclosed conduit. The annular space next the masonry between the conduit and the sheathing was then filled with grout, forming a solid ring to prevent leakage at the ends of the sheathing staves, and a ¾-inch hole was bored in the conduit. The sheathing protects the conduit from floating substances, and the water jacket insures its saturation by which decay is delayed.

The contract price for pipe laid without earthwork, manholes, blow-offs, etc., was $2.25 per lineal foot, and the total cost of the work, including inspection, was $30,412.90.

So long as suitable lumber can be had at a reasonable price it is believed that wood-stave pipe will be found more and more in favor with engineers under certain conditions, viz.:

Where from the nature or location of the ground, transportation is difficult.

Where, on account of the surrounding soil, corrosion would be particularly active.

In many cases where wood-stave pipe can be laid at less price than that of iron, steel, or masonry.

Where the greater weight of other material on the underlying soil would be objectionable, as in crossing marshes or swamps.

GLASGOW'S MUNICIPAL RAILROADS

PRIOR to 1904, says Prof. Frank Parsons in the *Arena Magazine,* only three municipalities in Great Britain operated their own tramways. In 1904 Leeds and Glasgow began to operate their street railways. One by one the cities and towns of the United Kingdom followed the Glasgow lead till now nearly all the large cities and towns in the kingdom have decided to manage their street railways for themselves, and about fifty municipalities in England and Scotland are already operating their tramlines.

The private company operating in Glasgow ten years ago with a service less than half as good as that established by the city and with longer hours and lower wages, collected fare from 25 to 100 per cent. higher than those charged by the municipal tramways at the start, and the city has lowered its tariff considerably since then. We pay the same five-cent rate we paid ten years ago.

In spite of her miscroscopic fares, Glasgow has already written off out of revenue about a quarter of the capital cost of the railways, putting the money into a fund for the renewal of the plant, besides considerable payments to the Common Good, and to a sinking-fund calculated to cancel the debt in thirty-one years. In three more decades the capital will be cleared away, the tramways will be free of debt and the fares can be reduced to the level of operating cost plus depreciation. The city has its own car shops and all but 80 of the 682 cars in stock were built in the workshops of the department.

On assuming the management of the tramways, the city at once carried into effect its ideas in respect to the amelioration of the conditions of labor. The hours were shortened from eleven and twelve to ten, and later the working hours were reduced to nine hours a day and fifty-four hours per week. Every man gets five days' holiday per year on full pay. The wages of the men were raised considerably above the wages paid by the private companies. The average increase was 16 per cent., and a considerable number of the men received a 25 per cent. advance.

The wages paid by the old company were four shillings a day. Those are still the wages of beginners, but the city increases the wages with each year of service, until at the end of the second year the pay becomes 4s. 8d. After three years it becomes 5s.; thirty shillings per week of fifty-four hours in place of twenty-four shillings for a week of 72 hours—an increase of 25 per cent. over the company wages per week, and 65 per cent. considering the hours, the old wage being 4d. per hour and the new 6.6d. per hour. The average wages received by the city tram-employees now is 4s. 8d. This is small according to our standards, but good pay according to British standards; a pound a week being considered a full wage for an ordinary workingman. The Glasgow trams pay 40 per cent. more than this.

The following shows some of the financial results:

	Just Before Transfer to City Operation.	Year to May 31, 1904.
1. Fares. Minimum	2 cents	1 cent
Aver. per passenger	3 cents	1.4 cents
Per mile	1.78 cents	0.90 cents
2. No. pass. per year	54,000,000	188,962,610
3. Total receipts	£334,304:7:6	£724,851:5:8
4. Oper. expenses	254,881:8:8	356,820:0:11
5. Fixed chgs. (including depreciation)	55,163:16:10	262,240:14:6
6. Profit	24,259: 2: 0	105,790:10:3
7. Number of employees	1,700	3,200 traffic
8. Average per day: Drivers and conduct	4s. ($1.00)	4s. 8d. ($1.16) Traffic
9. Average hours work per day	11 to 12	9
10. Salary of superintendent or head of tramway management	£1,500	£1,400

The company carried on a large omnibus, cab and carriage-hiring business in addition to the tramways.

PORTLAND CEMENT*

Its Uses in Emergency Constructions—Changes of Volume by Variations in Moisture and Temperature—Continued

By E. Kuichling, C. E.†

In the preceding number of the Municipal Journal and Engineer, the subject of the changes of volume of cement and mortar by variations in moisture and temperature was begun, and it is continued in the following article.

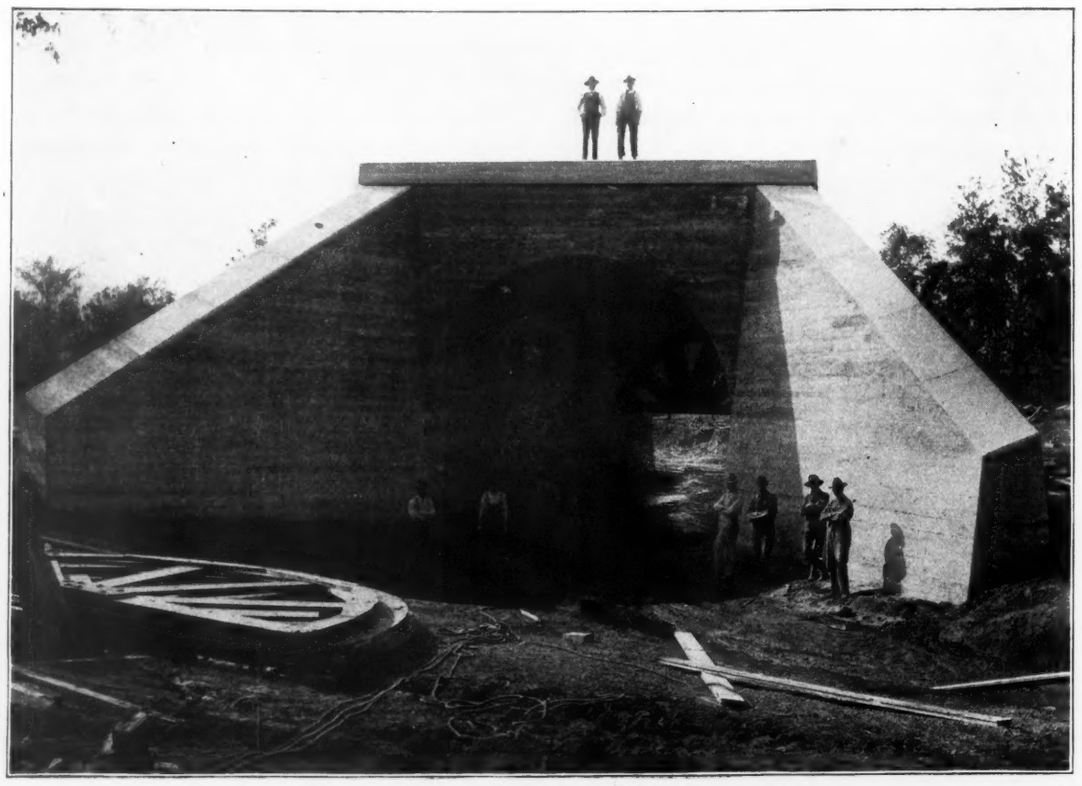
Changes of Volume during Induration

To exhibit in more detail the results of Bauschinger's experiments on the shrinkage of cements and mortars when hardening in air, and the expansion of the same when hardening under water, the following table referring to the observations made 16 weeks after mixture is submitted. In this table the minus (—) sign indicates contraction, and the plus (+) sign expansion of the initial volume, the figures being percentages of the length.

Description	Series No.	Average Shrinkage of 3 Cubes kept 16 Weeks in Air. (Per Cent.) Neat Cement	1 Cement 3 Sand	1 Cement 5 Sand	Average Expansion of 2 Cubes kept 16 Weeks in Water. (Per Cent.) Neat Cement	1 Cement 3 Sand	1 Cement 5 Sand
Cubes, 4.72 inches length	A	—0.137	—0.133	—0.098	+0.037	+0.001	—0.027
	B	—0.172	—0.105	—0.092	+0.153	+0.020	+0.023
of edge, made of mixtures with seven different brands of Portland Cement.	C	—0.123	—0.112	—0.105	+0.046	+0.008	—0.002
	D	—0.185	—0.103	—0.128	+0.036	+0.002	+0.003
	E	—0.339	—0.131	—0.137	+0.019	—0.002	—0.003
	F	—0.137	—0.120	—0.138	+0.022	+0.010	+0.006
	G	—0.240	—0.147	—0.126	+0.012	—0.002	—0.007
	H	—0.214	—0.121	—0.105	+0.025	+0.009	+0.000
	I	—0.169	—0.084	—0.081	+0.019	+0.022	+0.013
Averages		—0.191	—0.117	—0.112	+0.041	+0.009	+0.004

Similar experiments had also been made previously by Dyckerhoff with twelve brands of German Portland cement, to three of which he added 1, 2 and 5 per cent. of gypsum, in order to increase the time of setting, thereby obtaining 19 varieties of cement, with periods of setting ranging from 20 minutes to 14 hours. The test specimens were prisms 100 millimeters (3.94 ins.) long by 50 millimeters (1.97 ins.) square, made both of neat cement and mortar consisting of 3 parts sand to 1 part cement, and were left to harden in water from 1 week to 12 months. The results of these experiments are given in a paper by John Grant, C. E., in *Proc. Inst. C. E.*, for 1880, vol. 62, p. 177, and as they embrace a long period of observation, they are reproduced in table on page 114.

† Engineering Editor, Municipal Journal and Engineer.



20-FOOT STANDARD ARCH (END VIEW)—LOCATED 2½ MILES WEST OF CEDAR FALLS, IOWA, ON THE I. C. R. R.—LENGTH OF ARCH FROM FACE TO FACE, 106 FEET; EXTREME LENGTH ON FOUNDATION, INCLUDING WING WALL, 172 FEET; HEIGHT FROM BOTTOM OF FOUNDATION TO TOP OF COPING, 34 FEET; 2,200 CU. YDS. OF CONCRETE; 2,500 BARRELS OF "AA" PORTLAND CEMENT, MADE BY THE CHICAGO PORTLAND CEMENT COMPANY

PART I.

Cement No.	Time of Setting. Min.	Expansion of Mortar of 1 Cement to 3 Sand, in Per Cent. of Length, after Lying in Water for Time Indicated. of Neat Cement. 1 week.	4 weeks.	3 mos.	6 mos.	1 year.
A	240	0.025	0.048	0.072	0.078	0.107
I	480	0.024	0.047	0.059	0.071	0.084
E	540	0.122	0.154	0.171	0.191	0.202
F	600	0.023	0.041	0.058	0.075	0.091
H	600	0.014	0.026	0.030	0.041	0.059
C	660	0.014	0.029	0.037	0.055	0.070
B	30	0.047	0.067	0.081	0.094	0.123
D	35	0.047	0.092	0.113	0.148	0.187
G	35	0.044	0.085	0.110	0.132	0.165
K	20	0.069	0.113	0.152	0.180	0.213
K_1	210	0.032	0.062	0.088	0.111	0.127
K_2	360	0.090	0.158	0.198	0.223	0.258
K_3	600	0.097	0.159	0.193	0.217	0.252
K_4	840	0.413	1.449	1.761	1.781	1.805
L	120	0.043	0.088	0.119	0.140	0.151
L_1	420	0.054	0.104	0.136	0.156	0.167
L_2	600	0.101	0.144	0.167	0.193	0.204
M	30	0.053	0.080	0.097	0.107	0.120
M_1	300	0.060	0.095	0.112	0.127	0.140
* Av'ge	Slow Setting	0.020	0.038	0.051	0.064	0.082
† Av'ge	Quick Setting	0.052	0.087	0.111	0.132	0.162

PART II.

Cement No.	Time of Setting. Min.	Expansion of Mortar of 1 Cement to 3 Sand, in Per Cent. of Length, after Lying in Water for Time Indicated. of Neat Cement. 1 week.	4 weeks.	3 mos.	6 mos.	1 year.
A	240	—	—	—	—	—
I	480	—	—	—	—	—
E	540	0.039	0.044	0.049	0.051	0.057
F	600	—	—	—	—	—
H	600	0.004	0.008	0.008	0.008	0.012
C	660	0.007	0.009	0.009	0.009	0.010
B	30	0.013	0.017	0.018	0.023	0.032
D	35	0.017	0.019	0.020	0.024	0.032
G	35	0.009	0.012	0.012	0.013	0.022
K	20	0.016	0.026	0.032	0.037	0.043
K_1	210	0.012	0.019	0.023	0.031	0.035
K_2	360	—	—	—	—	—
K_3	600	0.027	0.042	0.042	0.045	0.050
K_4	840	0.140	0.443	0.463	0.466	0.471
L	120	0.018	0.030	0.040	0.045	0.046
L_1	420	0.017	0.029	0.032	0.036	0.039
L_2	600	0.026	0.034	0.040	0.043	0.047
M	30	—	—	—	—	—
M_1	300	—	—	—	—	—
* Av'ge	Slow Setting	0.005	0.008	0.009	0.009	0.011
† Av'ge	Quick Setting	0.014	0.019	0.021	0.024	0.032

NOTES.—* Refers to Cements A, C, F, H and I. † Refers to Cements B, D, G, K and M.

Cement E is abnormal in composition, probably over-limed.
" K_1 is same as K, but kept in storage 2 months.
" K_2 " " " with addition of 1% gypsum.
" K_3 " " " " 2% "
" K_4 " " " " 5% "
" L_1 " L " " 1% "
" L_2 " " " " 2% "
" M_1 " M " " 1% "

All the cements were very finely ground, leaving a residue of only 8 per cent. on the average on a sieve of 5806 meshes per square inch.

It will be noticed that the foregoing table refers only to the expansion of cements and mortars when kept under water. An examination of the figures shows that there is no marked regularity in the rates of expansion of either the neat cements or the mortars, except that such rate is greatest during the first month, when the increase in strength is most active. In the case of the mortars, the expansion sometimes ceases for several months, and is afterwards resumed. In other respects Dyckerhoff's conclusions, as submitted by Grant, on p. 108 of the paper mentioned, are:—1. All cements expand more or less when hardening under water, but with good cements the expansion is so very small that it need not be considered in practice; it also diminishes in proportion to the addition of sand. 2. The expansion is greater with newly made cement, and diminishes greatly when the cement has been kept long in storage; it is also increased by the addition of gypsum, and is greater with over-limed or lightly-burned cements than with those of normal composition or strong calcination. 3. All cements contract or shrink when drying, and expand on being replaced in water; the same is also true of various bricks and natural stones on which experiments have been made.

The behavior of cements and mortars during induration was also closely investigated from 1885 to 1887, by a committee of the American Society of Civil Engineers, of which Prof. George F. Swain was chairman. The reports of this committee are given in *Trans. Am. Soc., C. E.*, vol. 15, p. 717, and vol. 17, p. 213, et seq., the latter containing an account of the tests made at the Massachusetts Institute of Technology, with 6 brands of natural cement and 2 brands of Portland cement, all of American manufacture. Two 5-inch cubes were made of each cement mixture, one being left to harden in air and the other under water. The mixtures were neat cement and mortar consisting of equal parts of sand and cement, and in two cases mortar consisting of 1 part cement to 3 parts sand. Both horizontal diameters of each cube were carefully measured by an apparatus reading to 1/10000-inch, after the mixture had set from one hour to one day, and the observations were resumed at intervals of 1 day, 2 days, 1 week, 2, 4, 6, 8 and 12 weeks. At each observation the measurements were repeated from 3 to 8 times. Care was also taken to note the unavoidable differences in temperature in the apparatus and specimens at the different observations, but it was found that the corrections due to this cause were so small that they could be neglected.

The measurements exhibit many irregularities in behavior, especially during the first two weeks, sometimes indicating expansion and sometimes contraction, but after this time the changes in dimension became much more regular. To describe them in detail would occupy too much space, and reference is therefore made to the long table given in the report mentioned. From a careful study of the observations, the committee drew the following general conclusions: 1. Cement mortars hardening in air *contract* in linear dimension up to at least the end of 12 weeks, and in most cases progressively. At the end of 12 weeks the contraction of such mortars ranged from 0.14 to 0.32 per cent. in the case of neat cements, and from 0.08 to 0.17 per cent. in the case of mixtures of equal parts of sand and cement. 2. Cement mortars hardening under water *expand* in like manner, but to a less degree. At the end of 12 weeks the expansion of such mortars ranged from 0.04 to 0.25 per cent. in the case of neat cements, and from 0.00 to 0.08 per cent. in the case of mixtures of equal parts of sand and cement; but it is probable that the high limit of 0.25 per cent., given for the expansion reached by neat Newark and Rosendale cement after 12 weeks under water, is somewhat erroneous and excessive. If this single observation be excluded, the average expansion of the series of neat cements

will be 0.085 per cent., thus agreeing closely with the average found by Dyckerhoff for 10 German Portland cements.

In other respects the conclusions of the committee are: 3. The contraction or expansion of the specimens is essentially the same in all directions, and is greater in the case of neat cements than in the case of mixtures of sand and cement. 4. The change of dimension is greater when the mixture is kept in air than when kept under water. 5. Two of the quick-setting natural cements exhibited greater contraction when neat than the slower setting ones, but a third similar cement contracted somewhat less. The expansion of the quick-setting natural cements is also greater than that of the slow-setting cements. Furthermore, the committee finds a good agreement between the figures given above relating to the contraction of neat cements kept in air and those given by Bauschinger. For neat cements kept 12 weeks in air, the committee found contractions ranging from 0.14 to 0.32 per cent., while for neat Portland cements kept 16 weeks in air, Bauschinger found contractions ranging from 0.12 to 0.34 per cent. On the other hand, for neat cements kept 12 weeks under water, the expansion figures of the committee range from 0.04 to 0.25 (?) per cent., while Bauschinger's range from 0.01 to 0.15 per cent. after 16 weeks. For the sand mixtures a comparison cannot be made, as the proportions of sand and cement were unlike.

The report of the committee also cites the following interesting experience gained by the Department of Docks of New York. "Over ten years ago, when the upper portions of the new bulkhead walls, made of Portland cement concrete, were extended over considerable distances in monolithic masses, vertical cracks began to appear at irregular intervals. To remedy this, vertical joints were made in the masonry as it was built, at intervals of 150 to 200 ft. These joints have opened about ¾-inch, and do not appear to be affected by temperature changes. They have also stopped the appearance of irregular vertical cracks. As about one-half of the concrete in this part of the wall is alternately wet and dry by action of the tide, about one-fourth is immersed and one-fourth is out of water all the time. The contraction that undoubtedly takes place is the resultant of the expansions and contractions which occur sometimes together and sometimes separately, as the tide rises or falls. * * *"

"Very little attention seems to have been given by engineers to the serious effect of contraction that occurs on all concrete work that hardens in air. The makers of artificial stone pavements, however, soon found that it was necessary to introduce joints in their work, and when such joints are not made in large concrete constructions, trouble is sure to be experienced, as has been found in many cases. The Vanne aqueduct of Paris is a case of this kind. It was built about 1866 of concrete without joints, and is now said to be in bad condition. Cracks have appeared in many places and still continue to appear, so that serious leakage has resulted. * * *"

The results of another series of similar experiments, made by Dr. Tomëi, of Stettin, are given in a paper prepared by Prof. M. Gary, of Berlin, for the International Engineering Congress of 1893, and contained in *Trans. Am. Soc. C. E.*, vol. 30, p. 16. In this series, seven different brands of German Portland cement were used, the briquettes being prisms 100 millimeters (3.94 ins.) long by 500 sq. millimeters (0.78 sq. in.) sectional area, made in pairs, both of neat cement and of mortar composed of 1 part cement to 3 parts standard sand. One of each pair was allowed to harden in air and the other under water, the measurements of length being made soon after hard setting and then after 7, 28 and 90 days. The results for 28 and 90 days are given as percentages of the initial length in the following table, the minus (—) sign denoting contraction and the plus (+) sign expansion:

I.—Percentage of Contraction when Hardened in Air.

Cement	Neat Cement		Mortar 1 to 3	
No.	28 days	90 days	28 days	90 days
A	—0.121	—0.134	—0.034	—0.086
A*	—0.106	—0.160	—0.043	—0.060
B	—0.188	—0.260	—0.074	—0.123
C	—0.118	—0.175	—0.020	—0.068
D	—0.125	—0.185	—0.073	—0.090
E	—0.120	—0.175	—0.075	—0.110
F†	—0.252	—0.321	—0.072	—0.120
G†	—0.234	——	—0.058	——
Averages	—0.158	—0.201	—0.056	—0.094

II.—Percentage of Expansion when Hardened Under Water.

Cement	Neat Cement		Mortar 1 to 3	
No.	28 days	90 days	28 days	90 days
A	+0.037	+0.048	+0.012	+0.033
A*	+0.027	+0.003	+0.017	+0.020
B	+0.013	+0.010	+0.033	+0.035
C	+0.020	+0.010	+0.005	+0.030
D	+0.012	+0.019	+0.010	+0.005
E	+0.048	+0.035	+0.035	+0.043
F†	+0.035	+0.053	+0.020	+0.019
G†	+0.035	——	+0.020	——
Averages	+0.028	+0.025	+0.019	+0.026

* This cement was not ground as finely as the other sample.
† Cement of inferior quality, with low tensile strength.

For hardening during 7 days the averages were as follows: In air the contraction was 0.079 per cent. for the neat cements, and 0.023 per cent. for the mortars; under water the expansion or swelling was 0.019 per cent. for the neat cements, and 0.012 per cent. for the mortars. The two cements marked F and G were of inferior quality and exhibited an excessive shrinkage in air when used neat, but when mixed with sand this defect disappeared in large degree. The table also shows that there is no uniform relation between the contraction of cements and mortars in air and their expansion under water. From his study of the behavior of these materials in other respects, Gary reached the general conclusion that cements of low compressive strength and not made according to the accepted standards are liable to relatively great changes in volume according as they harden in air or under water. Thus it has been found by several investigators that an excessive proportion of magnesia causes a cement to swell unduly when hardening under water.

EXPERIMENTS OF DURAND-CLAYE AND DEBRAY

The progressive expansion of several French Portland cements, when kept under water for a long time, was also studied in an interesting manner by Durand-Claye and Debray, as set forth in *Annales des Ponts et Chaussèes*, 1888, vol. 14, p. 810. The test bars were slender prisms 800 millimeters (31.5 ins.) long by 12 millimeters (0.47 in.) square in section, made of neat cement placed between two

bars of metal on a marble slab. Much care was required in detaching and handling the fragile bars after setting to avoid breakage. Some of the samples were allowed to harden and dry, freely exposed for a few days in air, while others hardened under a covering of moist cloths. They were then placed upright in long glass tubes filled with water, the upper end of each rod being fitted to a delicate lever, whose fulcrum was attached to the glass tube, and which magnified the change of length ten-fold on a graduated scale.

The test specimen marked A in the following table was composed of Boulogne cement to which some calcined magnesia had been added, the mixture then being reburned. Specimen B was made of Campbon cement which was probably old and reburned. The remainder consisted of two varieties of Boulogne cement, one being well-burned and the other under-burned, the specimens marked with an asterisk (*) denoting the latter quality. As one purpose of the investigation was to ascertain the effect of immersing cement in sea water, which contains about 0.53 per cent. by weight of chloride and sulphate of magnesia, a number of the test bars were also placed in a solution of sulphate of magnesia in the proportion of 6 grams per liter of fresh water. In the case of specimens A, B, C and D, the fresh water in the glass tube was replaced by the solution mentioned on Jan. 1, 1887, while specimens J and L were placed in said solution from the outset. The observed expansions of the test bars at different dates are given in the following table:

Test Bar No.	Date of Immersion.	Expansion in Per Cent. of Length on Date of Immersion.	July 1, 1886.	Oct. 1, 1886.	Jan. 1, 1887.	Feb. 1, 1887.
A	June 9, 1886	0.050	0.144	0.669	0.911	†0.979
B	" 12, "	0.012	0.037	0.181	0.234	†0.242
C	" 18, "	0.050	0.063	0.091	0.094	†0.094
D‡	" " "	0.000	0.014	0.040	0.044	†0.044
E	Dec. 15, 1886	0.030	——	——	0.074	0.095
*F	" " "	0.044	——	——	0.082	0.120
G‡	" " "	0.000	——	——	0.030	0.057
*H‡	" " "	0.000	——	——	0.045	0.084
I‡	Feb. 19, 1887	0.000	——	——	——	Mar. 1 0.021
J‡	" " "	†0.000	——	——	——	†0.029
*K‡	" " "	0.000	——	——	——	0.059
*L‡	" " "	†0.000	——	——	——	†0.024

Test Bar No.	Date of Immersion.	Expansion in Per Cent. of Length on Date of Immersion.	April 1, 1887.	June 1, 1887.	Oct. 1, 1887.	Nov. 1, 1887.
A	June 9, 1886	0.050	†1.112	†1.289	†2.194	†2.251
B	" 12, "	0.012	†0.300	†0.365	†0.931	†0.981
C	" 18, "	0.050	†0.104	†0.115	†0.160	†0.187
D‡	" " "	0.000	†0.064	†0.076	†0.102	†0.109
E	Dec. 15, 1886	0.030	0.119	0.129	0.155	0.161
*F	" " "	0.044	0.135	0.154	c 180	0.184
G‡	" " "	0.000	0.081	0.094	0.124	0.131
*H‡	" " "	0.000	0.112	0.138	0.185	0.196
I‡	Feb. 19, 1887	0.000	0.050	0.070	0.102	0.106
J‡	" " "	†0.000	†0.069	†0.109	†0.149	†0.155
*K‡	" " "	0.000	0.059	0.076	0.097	0.102
*L‡	" " "	†0.000	†0.084	†0.109	†0.137	†0.142

NOTES.—* Denotes underburned Boulogne cement.
† Denotes immersion in solution of sulphate of magnesia.
‡ Denotes previous hardening under moist cloth.
All test bars were made 5 or 6 days before immersion.

The test bar marked A, consisting of magnesian cement, had become dry while hardening for six days in the air. On being immersed it soon began to expand, reaching an elongation of 0.04 per cent. of its length in half an hour and 0.05 per cent. in one day. It continued to expand at a nearly uniform rate from July 1 to October 15, 1886, but from the latter date to Jan. 1, 1887, when the fresh water was replaced by the aforesaid solution of sulphate of magnesia, its rate of expansion declined, and remained so until June, 1887. From June to October, 1887, the rate again increased, becoming about 50 per cent. more than during the same period in 1886, and then it again began to decline. Similar characteristics are exhibited by specimens B, C and D, although in lesser degree. It thus appears that the temperature exerts some influence on the rate of expansion or swelling of cement when kept under water, causing this rate to become greater in summer than in winter.

The relatively large elongations developed in specimen B confirm practical experience as to the unsuitability of the Campbon cement for use in hydraulic structures. The table also shows that the swelling of the same cements in the solution of magnesia, resembling sea water, soon becomes about 50 per cent. greater than in fresh water; and that with under-burned cement a greater expansion is to be expected in water than with well-burned cement. The experiments, however, are too few in number to warrant the formulation of any general conclusions other than with respect to the undesirable effect of magnesia, both as a constituent of the cement and when dissolved in the water in which the cement is placed; but they indicate that the swelling of good Portland cements immersed in water is of very small magnitude and without appreciable effect upon important structures.

INFLUENCE OF MAGNESIA

In reference to the effect of magnesia, when present as an ingredient of Portland cement, a spirited controversy has long existed and the question is still unsettled. As will be seen subsequently, the unsoundness of the mortar in many defective structures has been attributed to the presence of a considerable percentage of magnesia in the cement, the usual allegation being that it continues to expand by hydration for a long time after the completion of the work and to cause cracks to appear therein. Thus in 1890 it was reported in *Centralblatt der Bauverwaltung* and copied in other engineering journals, that according to recent investigations instituted by the authorities of various German railways, the swelling of cement mortars is due principally to magnesia, and that in the case of a recent bridge failure it was found that the cement used in the work contained 24.12 per cent. of this substance.

As many of our American natural cements, which were used with conspicuous success on numerous important works, contain relatively large percentages of magnesia, the foregoing condemnation of magnesian cements provoked sharp criticism from various manufacturers. One of the strongest of these criticisms is that of Uriah Cummings, of Stamford, Conn., in *Engineering News* of July 5, 1890 (vol. 24, p. 15), and also in his book entitled "American Cements," Boston, 1898, pp. 60-65. He states therein that no failure due to swelling of the mortar has ever been noticed on any of the important structures mentioned, which include specimens of the finest masonry ever built; that expansion or swelling will be avoided if the magnesia is combined chemically with silica, or if it is thoroughly hydrated

when uncombined; that silicate of magnesia will attain a hardness equal, if not superior, to that of silicate of lime; that the composition of the natural rocks used for making cement and the methods of calcination are such as to result in the formation of silicate of magnesia; and that in his long-continued observations of the behavior of experimental cements made by burning certain serpentines, or natural silicates of magnesia, neither shrinkage nor expansion was detected. It thus appears that the governing feature is whether the magnesia is chemically combined with silica, or is in a free state in the cement.

EXPERIMENTS OF KELLER

Another series of experiments to determine the swelling of hardened Portland cement and mortar at different degrees of moisture was made by Prof. Keller and reported in *Thonindustrie Zeitung* for 1894, p. 469. Two samples of the cement were analyzed chemically by Dr. Lustig, of Carlsruhe, and showed the following percentage composition: CaO, 62.90; SiO_2, 21.58; Al_2O_3, soluble, 3.47, insoluble 2.00; Fe_2O_3, 1.87; MgO, 1.11; $CaSO_4$, 2.44; alkalies, 2.00; sand, 0.42; loss on ignition, 2.29; total, 100.08 per cent; specific gravity, 3.15. The test bars were prisms 300 millimeters (11.81 ins.) long by 70 millimeters (2.76 ins.) square in cross-section; their composition ranged from neat cement to a mortar consisting of one part cement to 8 parts of a mixture of river sand and gravel in equal proportions, and after fabrication they were kept 24 hours in air and several months under water for the purpose of obtaining the rates of expansion by changes of temperature, as will be set forth subsequently.

On being taken from the water, after the conclusion of the first series of measurements, the prisms were thoroughly dried for several days in an oven and then exposed for two days in air of ordinary temperature, whereupon their length, weight and temperature were carefully observed. They were then immersed for two days in water of known temperature and again weighed and measured. In this manner from 24 to 30 observations were made on each of the six prisms representing different mixtures and degrees of saturation or moisture, the total number of determinations being 178. Having found previously the co-efficients of variation in length due to changes of temperature alone when kept under water, it thus became possible to reduce the second set of measurements to a uniform standard temperature of 0° C., or 32° F., for different weights or percentages of water absorbed by the prisms; and the results so computed showed the following average elongations per one per cent. of water absorbed:

Prism No....	I.	II.	III.	IV.	V.	VI.
Composition..	Neat cement.	1c + 1s&g	1c + 2s&g	1c + 4s&g	1c + 6s&g	1c + 8s&g
Coefficient of elongation per 1% water absorbed	0.000090	0.000073	0.000072	0.000042	0.000033	0.000027

The practical use of these figures is illustrated by the following example: A garden wall made of concrete mixed in the proportion of 1 part cement to 2 parts sand and gravel, and 17 meters (55.77 ft.) long, is exposed to a difference of 40° C. (72° F.) temperature between summer and winter, and in the coldest period its moisture is 4 per cent. less than in the warmest period; what is the difference in length at the two periods, assuming that the co-efficient of expansion of the material by change of temperature alone and for a constant degree of moisture, is 0.0000101 per 1° C. (as will be seen hereafter)? For 40° C. from summer to winter, the contraction will be $17 \times 40 \times 0.0000101 = 0.00687$ meter, and for 4 per cent. less moisture the additional contraction will be $17 \times 4 \times 0.000072 = 0.00489$ meter, thus making the total contraction from both causes = 0.01176 meter, or nearly 12 millimeters (0.47 in.). This computation was found to be verified by the actual shrinkage of a wall of this identical kind and length during a prolonged cold and dry period in winter, when a space 6 millimeters wide at each end of the wall was found open next to the adjacent buildings, while in the summer the wall abutted tightly against said buildings.

ABSORPTION OF WATER BY DRY CEMENT MORTARS AND STONES

These experiments of Prof. Keller, together with the foregoing example, indicate very clearly the relative effects of changes of temperature and moisture in structures of concrete. The quantity of water absorbed by the different mixtures, however, is not stated, and to supply data relating thereto it becomes necessary to make use of other investigations. The results of a number of experiments by W. W. Maclay, C. E., on the absorption of water in various periods of time by perfectly dry mortars of different composition, are given in *Trans. Am. Soc. C. E.* for 1887, vol. 17, p. 215, as follows:

Kind of Cement.	Composition of Mortar.	Percentage of Weight of Dry Cement Mortars Gained after Immersion in Fresh Water for			
		12 hours.	36 hours.	7 days.	79 days.
Portland	Neat Cement	11.20	11.20	12.06	13.08
"	1c + 3 sand	9.20	10.90	10.90	15.08
Rosendale	1c + 1 sand	11.00	11.00	11.00	15.06
"	1c + 2 sand	11.00	11.00	11.00	15.40

From these figures it will be seen that in a few hours dry cement mortars will absorb a relatively large quantity of water, thus leading to expansions of considerable magnitude; also that the absorption seems to increase after a few weeks in proportion to the addition of sand. It should, however, be borne in mind that the absorption depends on the density of the mass, and that the latter in turn depends on both the character of the sand and the method of fabrication.

Natural stones are simply more or less coherent aggregates of minerals, each of which possesses distinctive physical properties. In crystalline rocks the dissimilar constituents are practically in actual contact, while in sandstones the particles are slightly separated and the interstices are filled wholly or in part by a ferruginous, calcareous or silicious cementing material. It has been found by experiment, however, that almost every variety of rock will increase in weight to some extent after a long immersion in water, and that this increase depends essentially on the porosity of the material. To determine the ratio of absorption, specimens of about two cubic inches in volume and of cubical or prismatic shape, are first carefully dried and weighed; they are then soaked in water for 24 hours or longer, and weighed again after quickly wiping off the moisture on the surface; the increase in weight is obviously due to the quantity of water absorbed, and its percentage of the dry weight is

easily computed. In this manner many observations have been made by different investigators and some of the results are given in the following table:

Kind of Stone.	Per Cent. of Water Absorbed.
18 varieties of Granite from several States	0.17 to 0.71
2 " Gneiss " New York and Connecticut	0.50 " 0.62
3 " Lava " Colorado	3.18 " 9.76
20 " Limestone " several States	0.72 " 4.54
3 " " " Colorado	0.07 " 1.36
6 " " " Indiana	0.30 " 2.33
8 " Oolitic Limestone from Indiana	1.43 " 5.56
7 " Dolomitic " " Minnesota	3.98 " 5.56
Lower Silurian Limestones and Dolomites from Canada	0.11 " 5.56
4 varieties of Marble from Vermont, Wisconsin & Illinois	0.15 " 1.35
7 " Sandstone " New York and Connecticut	1.43 " 4.35
4 " " " Ohio	2.70 " 6.43
6 " " " Michigan and Wisconsin	3.12 " 7.34
7 " " " Minnesota	6.00 "12.50
28 " " " Colorado	0.77 " 9.69
Subcarboniferous " " Ohio	9.59 "10.22
Potsdam " " Canada	0.50 " 3.26

The percentages of water absorbed were found after soaking the specimens from several hours to eight days. In many instances different samples from the same quarry or locality exhibited widely different ratios of absorption, and hence averages become of little value for practical use in computations of the kind indicated above. Where reasonable accuracy is desired, the absorption of the material under consideration must obviously be determined by direct experiment. The table, however, is instructive in showing the range of the rates of absorption of different kinds of stone that may be used in concrete.

RECENT EXPERIMENTS ON CHANGE OF VOLUME OF CEMENT AND CONCRETE BY HARDENING

The recent investigations by Considère and others of the properties of reinforced concrete have again directed attention to the surroundings in which Portland cement is placed in practice, and a number of new observations on the change of volume during the hardening process in air and water have become available within the past few years. These measurements of small prisms are not materially different from those made about twenty years ago, and as an example, reference may be made to the tests of Atlas cement by two eminent British chemical engineers, Wm. H. Stanger and Bertram Blount, as reported in *Proc. Inst. C. E.* for 1901, vol. 145, p. 64. According to this authority the composition of the cement was as follows: CaO, 61.90; SiO_2, 20.36; Al_2O_3, 7.26; Fe_2O_3, 3.24; MgO, 3.10; SO_3, 1.36; CO_2, 0.33; H_2O, 1.97; alkalies, 0.04; insoluble residue, sand and clay, 0.44; total, 100.00 per cent.; and prisms of neat cement, 100 millimeters (3.94 ins.) long, exhibited the following changes of length when kept respectively in air and in water:

Age of prisms of Atlas cement, in days.	1	7	28
Elongation of prism kept under water, in %	0.015	0.035	0.045
Contraction " in air "	0.070	0.095	0.135

In relation thereto the authors remark that the stated changes in length are such as may be expected to occur with all good Portland cements, and that the chemical composition of the cement is normal.

Considère states that these changes of volume may reach 0.2 per cent. for blocks made of neat cement, while in the case of mortars and concrete the changes diminish in magnitude in proportion to the admixture of sand and ballast, but will not be much below 0.04 per cent. for the poorest concrete generally used in construction. In many cases the changes extend over a period of a year or more, but usually the additional changes that take place after three months are exceedingly small. He also found that both the swelling by absorption of moisture and the shrinkage by desiccation, independent of temperature changes, are considerably different from the figures given by Schumann. Thus a prism of neat cement which had been kept in dry air for two years, elongated 0.024 per cent. after three weeks' immersion in fresh water, while a prism of mortar composed of 1 part cement to 3 parts sand, which had been kept fifteen months in water, shortened 0.050 per cent. after being in dry air for two months. It therefore appears that the changes in volume caused by variations in degree of moisture are greater in mortars than in neat cement.

Some interesting observations on the shrinkage of concrete after setting were also made in 1901 under the direction of Howard A. Carson, Chief Engineer of the Boston Transit Commission. They are given in the Report of the Commission for 1901, pp. 31 and 43. The specimens were two concrete beams, each about 9.0 ft. long by 8 inches square in section, and were presumably mixed in the proportion of 123 lbs. dry Portland cement to 2.5 cub. ft. sand and 4.0 cub. ft. gravel. The weight of a cubic foot of the cement used is not given, but if it be assumed at 82 lbs., the volumetric proportions of the mixture will be 1 part cement to 1.67 parts sand and 2.67 parts gravel. One of these beams was kept in air and anchored at one end to the masonry of the subway, its free end being connected by a lever to the trunnion of a transit instrument in such manner as to cause the telescope to turn in a vertical plane with any change in the length of the beam. The telescope was directed to a vertical leveling rod about 240 ft. distant from which readings were taken, and by this device the movements of the free end of the beam were magnified about 3,850 times.

During the period of observation some changes of temperature took place, and an allowance of 0.0008-inch for each degree F. was made for expansion. From the data thus acquired the conclusion was reached that if the temperature remained constant, the shrinkage of the concrete kept in air would be about 0.028 per cent. in twelve weeks. The second beam was kept in water for twelve weeks, and by making the same allowance for changes of temperature, it was found that at the end of this time a *shrinkage* of about 0.019 per cent. had taken place. This result is contrary to what would be expected from most of the experiments previously cited, as the length of the beam should have increased slightly when hardening under water. It is to be regretted that the report mentioned gives no further details concerning the behavior of the two beams.

(To be continued.)

Col. A. A. POPE, President.

JOHN FARSON, First Vice-President.

COL. W. L. DICKINSON, Second Vice-President.

ARTHUR H. BATTEY, Secretary.

NEW YORK AND CHICAGO ROAD ASS'N

An Important Convention to Be Held at Elmira, N. Y., March 20-21—Speakers of National Reputation to Be Present

WHEN the New York and Chicago Road Association was formed, nearly three years ago, with the avowed object of securing the construction of a first-class modern highway between the metropolis of the coast and the great city on the lakes, there was a full understanding of the difficulties in the way. To carry on the work of the Association with no financial aid save that obtained from the dollars of individual members was in itself a problem of no small magnitude, but it was determined that no special interest should be favored by accepting money from its representatives in sufficient sums to give them even a shadowy hold on the conduct of its affairs, and this plan has been carried out, with one exception.

When the first route was mapped out it was merely tentative, and subject to change if circumstances seemed to warrant an alternation which would not interfere with the aim of the Association, to provide a route between the two cities which would be of use to every one along the line as well as to the cities and towns which it touched. The original plan covered crossing the Hudson at 42d street, New York, and reaching Kingston by way of the roads on the west side. Later it was pointed out that crossing the river at Rhinebeck, directly opposite Kingston, would be just as convenient, and, in addition, would enlist the co-operation of many people on the east side of the river who would benefit by an improved highway between New York and the northern end of the line. Col. John Jacob Astor offered valuable assistance to the project as amended, and the change was made in the plans, the main road as now outlined running up the east bank of the Hudson. A further consideration resulted in efforts to carry out the west side plan, thus providing two routes between the starting point in the east to the city where the turn is made westward, and both are well under way.

In March last the first annual convention in the United States favoring continuous lines of inter-State highways was held at Erie, Penn., under the auspices of this Association and the Erie Chamber of Commerce. The convention lasted two days, and resulted in active measures being started looking toward the completion of the route across the Panhandle of Pennsylvania. It was attended by many prominent men: Senator Asbury C. Latimer, of South Carolina; Hon. Frank Z. Wilcox, of New York; Hon. James H. Macdonald, State Highway Commissioner of Connecticut; Hon. Horatio S. Earle, State Highway Commissioner of Michigan; State Highway Commissioner Hunter, of Pennsylvania; Frank D. Lyon, representing the State Engineer of New York, and others, being among the speakers.

The second annual convention, with the same objects in view, is now scheduled for March 21-22, of this year, at Elmira, N. Y., and this time with co-operation of the Chamber of Commerce and city officials. The program, as outlined, calls for a general survey of the work so far accomplished in New York State, the formation of plans for future work, addresses by well-known good roads men, a trip of inspection over portions of the work already completed or underway in Chemung County and other features of interest to those who favor improved highways. The official program has not yet been completed, as definite answers are awaited from men of national prominence who have been invited to attend, but the success of the convention of a year ago shows that there will be no lack either of enthusiasm or effective work for the cause.

Reports received by the secretary announce encouraging progress at various points along the line, everywhere, except in Indiana, where the work is a little backward. Committees are busy in New York, Pennsylvania, Ohio and Illinois, and special efforts are being planned for work in the Hoosier State.

The association is not a money-making concern; it is not an organization to provide good salaries for a number of officers, as no one of its officers or members receives any pay or emolument whatever for his services in its behalf. It is simply a banding together of people working for a common cause, who feel that united action is more potent than individual effort, and that through organization results may be brought about which would be beyond the power of anyone to accomplish single-handed.

That the cost of constructing a highway such as that planned by the Association would be too great for any single organization to meet is self-evident, and it is through

the operation of the State aid laws in the various States traversed by the line that this Association expects to complete its work. Where there is no provision made by the State for aid in road building, the Association uses all its powers to secure the election to the Legislature and to the county and local offices such men as realize the great economic value of good highways, and who will pledge themselves, regardless of partisan politics, to work and vote for the proposed improvements. The Association has no political significance, save where politics are necessary to the completion of its work, and knows no party save the one which will insure the improvement of the peoples' great lines of communication, the highways of the country. Agitation through the aid of the press, dissemination of literature regarding the project, personal visits by representatives of the Association, and conventions at important points along the line, are among the means used to keep alive public interest in the aims of the Association, and the more assistance given the organization the quicker will its work be accomplished.

The proposed route leads from New York City up the east side of the Hudson River to Rhinebeck, thence through Ulster, Delaware, Broome, Chenango, Tioga, Chemung, Alleghany, Cattaraugus and Chautauqua counties in New York, to Erie, Pa.; thence it follows the lake shore to Toledo, Ohio, and on to Chicago through Indiana. Among the important cities and towns the route touched are Poughkeepsie, Kingston, Oswego, Elmira, Corning, Hornellsville, Salamanca, Wellsville, Jamestown and Westfield, in New York; Erie, Pa.; Ashtabula, Cleveland, Lorain, Sandusky, Clyde, Fremont, Toledo and Bryan, in Ohio; Butler, Goshen, South Bend, La Porte, Valparaiso and Hammond, in Indiana; and Chicago.

The officers of the Association are: President, Col. Albert A. Pope, Pope Manufacturing Co.; first vice-president, John Farson, Farson, Leach & Co., Chicago; second vice-president, Wm. L. Dickinson, road expert, Springfield, Mass.; treasurer, Col. George Pope, and secretary, Arthur H. Battey, editor New York *Tri-Weekly Tribune.* The Board of Directors is composed of Col. Albert A. Pope, John Farson, Wm. L. Dickinson, Wm. S. Crandall, editor MUNICIPAL JOURNAL AND ENGINEER; F. C. Donald, Chicago, Commissioner Central Passenger Association; Arthur H. Battey, and Frank D. Lyon, Binghamton, N. Y., State Engineer's Office.

The membership fee is only $1 a year, which may be sent to the Secretary, at 154 Nassau street, New York City.

NATIONAL BRICK MAKERS MEET IN CONVENTION

THE nineteenth annual convention of the National Brick Manufacturers' Association was held at Birmingham, Ala., Feb. 1-3, with registered attendance of 226.

Vice-president W. A. Endaly, of Cincinnati, presided and read the address of President W. S. Purington, who was absent on account of sickness. Routine business was taken up during the first session. The treasurer's report, beginning with a balance on hand of $863.79, showed receipts of $480 for membership fees; $1,287 from dues and $1 from sale of pamphlet, a total of $2,631.79, and expenditures of $1,906.06, leaving a balance of $724.73.

The officers chosen for the ensuing year were: President, John Milton Blair, of Cincinnati, Ohio; first vice-president, J. R. Copeland, of Birmingham, Ala.; second vice-president, Edward B. Fish, of Rochester, N. Y.; third vice-president, J. F. Lewis, of Jackson, Mich.; secretary, T. A. Randall, of Indianapolis, Ind.; treasurer, John W. Sibley, of Birmingham, Ala.

A trip to the clay and brick plants and the steel furnaces of the neighborhood occupied the morning of the second day of the convention. At the afternoon session Prof. Edward Orton, Jr., of Columbus, Ohio, read a paper on *The Testing of Clay,* as exhaustive and thorough as the authorship suggests. Prof. C. W. Parmelee, of New Brunswick, N. J., considered the subject of *The Uses of Clay* in a humorous vein.

What are the Relative Merits of Cement and Asphalt Fillers for Brick Pavements? was discussed by H. C. Innes, C. E., of Cincinnati, in a paper that THE MUNICIPAL JOURNAL will publish in a future issue.

Colonel R. W. Richardson, of the National Good Roads Association, had been invited to deal with the question of *The Good Roads Movement and the Part Paving Brick Should Have in it* and advocated a construction with the sub-grade underdrained at low or flat places with a 6-inch tile in the center and a 4-inch tile on each side. The foundation is then cut out in same manner as in the building of macadam roads and thoroughly rolled with a 10-ton steam roller. It is given a crown of three inches from the center to the sides. A curb of plain pine boards, 1x6 inches, is placed on the sides. The first course is then laid of crushed lime-stone to the depth of four or six inches after compact, as the character of the road, estimated by the weight of traffic, requires. This course to be properly laid, bonded and rolled. Upon this is placed the usual cushion of sand, about two inches in thickness, properly spread, shaped and tamped. Upon this is laid the regulation size paving brick placed on edge, close together, crosswise of the road, alternating courses breaking joints, and fitted close against the curb, their surface being flush with the top of it. Dry, sharp sand is then spread on to the depth of about a half inch and swept into the voids between the bricks, the whole to be rolled to a uniform surface. The wooden curb is flanked or reinforced on the outside with a strip of crushed stone, or with gravel or slag, rolled down to the requisite depth and sloping to the outer line. The brick wheelway is built nine or ten feet wide, the road fourteen or fifteen feet.

A paper on the durability of brick subjected to fire, as illustrated in the great conflagration at Baltimore, was read by Albert D. Klein, of that city, and the convention closed with articles on the practical work of manufacture.

The business sessions were followed by the regular annual banquet, at which Mr. John W. Sibley officiated as toastmaster.

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Telephone Investigation Seems Assured

PRESENT indications point to a thorough investigation of the oppressive telephone service in New York City and it is to be hoped that a speedy relief will be the result. This is the outcome of a quiet but persistent effort of THE MUNICIPAL JOURNAL, started many months ago for the purpose of provoking just such an inquiry. Then we were alone, but now the movement has reached such proportions as to be practically out of our hands, for, backed by the New York *Herald*, the New York Board of Trade and Transportation, Senator Keenan has introduced a resolution in the State Legislature, which calls for a joint public hearing on the telephone situation in this city, March 7th. That the rates charged for service in New York, by the Bell Companies, are oppressive is sufficiently shown in the following table of comparative rates collected by Senator Keenan:

City	1,200 Calls.	2,400 Calls.	3,000 Calls.	4,500 Calls.
New York	$111.00	$165.00	$183.00	$228.00
Chicago	105.00	144.00	162.00	207.00
Boston	91.00	127.00	145.00	190.00
Philadelphia	87.00	132.00	150.00	195.00
Pittsburg	76.00	112.00	130.00	175.00
St. Louis	74.40	110.40	128.40	173.40
Buffalo	60.00	104.00	122.00	167.00
Washington	75.00	114.00	132.00	177.00
Omaha	60.00	96.00	114.00	159.00
Kansas City	55.20	101.20	119.20	164.20
Cleveland	60.00	96.00	114.00	159.00
Denver	68.00	92.00	104.00	.....
Rochester	48.00	84.00	102.00	147.00
Salt Lake	48.00	78.00	93.00	130.50
Richmond	36.00	72.00	90.00	135.50
Troy	48.00	72.00	84.00	114.00
Syracuse	40.00	64.00	76.00	106.00
Grand Rapids	30.00	60.00	75.00	112.50

A year ago, Mr. John Brooks Leavitt, of New York, published an article in *The Arena* upon the telephone situation in New York City, from which the following excerpts are made:

"In view of the fact that unlimited service can be had in the country for $50 a year, a tax of $150 is *prima facie* unconscionable. Such a discrepancy would appear to be sufficient of itself to require an answer. The monopoly has, however, a reply which so far has been triumphant because no one has been able to demonstrate its fallacy. The monopoly asserts that the cost of service increases in geometrical ratio with the number of subscribers. The truthfulness of this proposition depends on facts and figures which are concealed in its books. Expert testimony, too often a purchasable commodity, is ready to back up the statement. The individual subscriber who wishes to test its truth in a lawsuit is handicapped by the expense. As between hundreds for a telephone and thousands for law he must be a long pursed as well as a public spirited citizen who would choose the latter alternative.

"Therefore, the monopoly stands intrenched in a position seemingly impregnable. And yet, while the individual cannot overthrow the monopoly's proposition in court except at a prohibitive cost for lawyers and experts, one simple consideration is enough at the bar of public opinion. The monopoly has never produced its books in support of its claim that the cost of serving its gigantic list of subscribers prevents it from reducing its charges.

"It is a familiar principle in the law of evidence that if a party has at his hand a witness who or a document which would shed light on a transaction and fails to produce him or it in court the presumption is that the evidence thus withheld would be against him rather than in his favor. Judges charge this to juries as a matter of course. So long as the monopoly refuses to show what becomes of its known receipts it has no right to ask its subscribers to accept its defence as true.

"In country districts are many companies who serve a thousand subscribers within a radius of ten miles at a cost of $50 each. The sum of $50,000 suffices to pay the cost of service to one thousand persons, the royalty to the monopoly and a fair dividend on the capital invested. In New York 100 000 subscribers within a radius of ten miles pay into the company's coffers $15,000,000.

"Now it is simply absurd for any one to claim that the cost of serving 100,000 subscribers is so great that out of $15,000,000 of revenue there is only left enough to pay reasonable dividends and royalties. Either the expense is falsified or the dividends are too large or the royalties are exorbitant. The general law of economics is that the greater the demand the less is the cost of supply to each unit of the demand, and we may rationally conclude that it has no exception in telephony. A charge of $150 a year for telephone service in our great cities is unconscionable."

New Home of The Municipal Journal

THE MUNICIPAL JOURNAL has developed so rapidly that it requires much larger space in which to care for its present business and provide for its future growth. From a 32-page monthly the magazine has increased to over a hundred pages a month in four years. As additional space, suited to its needs, could not be had at 253 Broadway, it became necessary to locate elsewhere. The new offices will be found in the Nassau-Beekman Building, 140 Nassau street, within a short distance from the old offices and within sight of City Hall, so that it will not be difficult to find the new address.

A Suggestion for Paving Brick Manufacturers

CAPTAIN W. H. GRAVES, of Birmingham, one of the leading paving brick manufacturers of the country, made a most pertinent suggestion in responding to the toast, "The Benefits of Organization to the Brick Manufacturer," at the banquet held in connection with the recent meeting of the N. B. M. Association, at Birmingham, Ala. After referring to the general benefits accruing to members of the association, such as practical ideas secured from the papers read and the commingling of the delegates, he said:

"I now have a few words to say to the manufaturers of paving brick about the need of organization among ourselves for the purpose of educating the officials of different cities and towns in the United States as to the merits of paving blocks for street paving purposes. I will venture to say that we have done less along this line to further our interests than any other manufacturers who have invested as much capital in business as we have.

"If you will investigate the matter as I have, you will find that the asphalt paving companies have spent hundreds of thousands of dollars in advertising and pushing their business in every part of the country, and have succeeded in putting down an immense quantity of their pavement in almost every city in the United States.

"Now I suggest that the manufacturers of paving blocks shall organize among themselves for the purpose of presenting the merits of their products to all persons interested in having first-class pavements. I would further suggest that we employ some competent persons to prepare and furnish a pamphlet or book giving all necessary information on the subject with information and data gathered from statistics from our principal cities, and mail one to every city engineer and mayor in the United States. I think it would be well to solicit every manufacturer of paving brick belonging to this association to join in this organization."

This suggestion of Captain Graves is in line with the work that THE MUNICIPAL JOURNAL has been performing for the paving brick industry as well as other kinds of paving in the United States. He is right when he states that the success of other kinds of paving has been due more largely than from any other one cause to intelligent publicity, both general and specific. This is why there are more than 5,000 miles of asphalt streets in American cities as compared with about 1,500 miles of brick pavement. No one that knows anything about paving brick will dispute the fact that paving brick is to be classed among the best and most durable forms of pavement, but even an ideal pavement will not sell itself; will not advertise itself. Publicity costs money and requires intelligence, and we believe that Captain Graves is perfectly right in his statement that paving brick manufacturers of the country should organize for a united effort to bring to the attention of the public everywhere the merits of brick pavements. This can be done without at all detracting from the merits of other forms of pavement, and with satisfactory results to the paving brick industry.

It is no undue assumption of superiority on the part of THE MUNICIPAL JOURNAL to claim that it is the only medium which goes to all the people in the United States who are interested in not only paving brick but every other kind of pavement. There are other engineering journals, but they are not read by all departments of the city government as is THE MUNICIPAL JOURNAL. This journal gos to the head of every department in the municipal administration, including the mayor and aldermen, and in consequence is more helpful both to the manufacturer of paving materials and the municipality that wishes to obtain a kind of pavement best adapted to its needs, and that will yield the best results for the money expended. We hope that the suggestion of Captain Graves may be soon adopted and put in force by the brick manufacturers.

Chicago's Municipal Museum

THE city of Chicago comes in for a large amount of criticism. In some points the criticisms are merited, but when it comes to the adoption of some new and up-to-date idea about municipal reform or development of any plan for the special or general betterment of the city, Chicago may be counted upon as taking the sensible course. This is something which cannot be said of other large cities. For instance, New York is self-complacent and provincial, and was never known to do the wholly sensible thing in installing any great improvement. Philadelphia is slow, sleepy and contented, and consequently inactive. It has remained for Chicago, the youngest great city of the United States, to establish the first municipal museum to be founded in this country. This honor should have belonged to New York, but it was too slow. The Chicago museum was formally opened on February 23d, when addresses were given by Hon. Carter H. Harrison, Mayor of the City; Theodor Lewald, Imperial German Commissioner General; Miss Jane Addams, Robert R. McCormick, Esq., Edw. B. Butler, Esq., and Geo. E. Vincent, Esq., the last four being prominent citizens of the city.

In connection with the opening of this museum, there was held the first loan exhibition, in which are to be found original drawings, models, photographs, maps, charts and literature, contributed by many foreign and American cities, among which are New York, Boston, San Francisco, St. Paul, Minneapolis, St. Louis, Berlin, Dresden, Dusseldorf, Bonne, Cologne, Essen, Paris and minor French cities, Birmingham, Manchester, Liverpool, Glasgow, Tokyo and Buenos Ayres. Besides, a large collection of exhibits has been loaned by organizations such as the Municipal Art Society of New York and the Louisiana Purchase Exposition, St. Louis.

The scope of the Municipal Museum is indicated in part by the following classification: Municipal administration, public art, public recreation, street making, street cleaning, transportation, sanitation, housing, education and school expenses, libraries, charity and correction, civic literature and statistics.

Next April it is expected that a permanent collection of exhibits relating to the city of Chicago will be opened. At that time there will be addresses from prominent citizens upon various civic topics, including government, history, improvements, parks and playgrounds, the development of the city plan, charities and correction, sanitation, transportation, housing conditions, school extension, neighborhood improvement and "Making Chicago a Better Place to Live In."

Chicago was not the first place to suggest the idea of a municipal museum, for it was seriously discussed by the Municipal Art Society of New York several years ago, but nevertheless Chicago should have the credit of being the first to act. If New York were inclined, it could excel any other city in this country in the development of such a museum, for it possesses a larger amount of requisite material than can be found anywhere else. It is to be hoped that New York and other large cities will follow the good example set by Chicago.

Death of Frederick John Warren

FREDERICK JOHN WARREN, of Cambridge, Mass., president of the Warren Brothers Company, of Boston, died suddenly at the Hotel Essex, in the latter city, Tuesday, February 21st, about 1 P. M. Mr. Warren had just returned that morning with his wife from a combined business and pleasure trip to New York. After breakfasting with Mr. Warren at the Hotel Essex, Mrs. Warren returned to their home in Cambridge, while he took a room in the hotel, telephoning his office that he felt tired and would take a needed rest and not go to the office till about 11 o'clock. As Mr. Warren had not arrived at the office at 1.30 P. M., and as there were some important matters requiring his attention, one of his brothers went to his room and found him resting in an easy position on the bed, but apparently lifeless. A physician was immediately summoned, who, after a careful examination, said that he had died from apoplexy, probably only a few minutes before.

Although working unusually hard during the past five years, he was in apparent good health and had only expressed himself as being tired. Friends whom he saw in New York the evening before his decease say that he was in excellent spirits.

Besides a wife and daughter, aged twelve, Mr. Warren is survived by two sisters—Mrs. W. F. Arnold, of Fairport, N. Y., and Mrs. Dr. William T. Shoemaker, of Philadelphia—and six brothers—Albert C., Henry J., Herbert M., George C., Walter B., and Ralph L., all of whom are members of the Warren Brothers Company. Mr. Warren was a son of the late Herbert M. Warren, of Newton, Mass., where he was born, February 18, 1866, and had, therefore, just passed his 39th birthday.

Mr. Warren was the organizer of the Warren Brothers Company, which has developed under his guidance, the cooperation of his brothers, and other experts in the business, into the most phenomenal paving industry this country has ever known. Like his brothers, he began his training in the asphalt business at an early age, beginning the practical work in 1883, in his nineteenth year, becoming associated with one of the Warren Companies, his father and uncle having been engaged in the business of refining and use of bitumen since 1845, and, in fact, having started the business in its several branches. He rapidly progressed in his chosen work and soon was appointed to positions of trust and responsibility. Although handicapped a part of this time by impaired health, he succeeded in spite of all difficulties and was noted for his thorough work, adding much to the knowledge of the industry by his original investigations and research in the laboratory and elsewhere.

In 1898 he retired from his connection with the asphalt paving business in the West and returned to his old home, Newton, Mass., where he entered upon an important line of laboratory work covering a period of three years and leading to most important discoveries. The results of this work formed the basis of a series of patents granted for improvements in pavements, the first of which bears the date of June 4, 1901. On March 11, 1902, three other patents were granted, while on May 5, 1903, eight additional patents were granted. Since that date seven other patents have been granted, making nineteen in all, and others are pending. These patents cover all the important points in the construction of the bituminous or bitulithic pavement, and manufacture of bituminous cement.

Mr. Warren was a man of remarkable abilities in his profession and was dominated by a high ambition. He possessed a mental equipment which, though still a young man, had made him eminently successful in his line of research. Taking the opinions of the most eminent engineers and others engaged in the paving industry, in the fields of supervision, practical construction and laboratory work, it is generally conceded that he has given to the world the best form of pavement ever made, and one which it will be difficult to equal. This, in itself, is an achievement of which any man could be proud, even as the result of a long life's labor. The business he has so successfully organized is on a permanent basis and it seems hard that he should not be permitted to enjoy the fruits of his labors.

In concluding this brief mention of the strong characteristics of Frederick J. Warren the following excerpt is taken from an appreciative editorial from the Utica (N. Y.) *Press*, in which city he was well known: "Mr. Warren was an expert in paving and paving matters, having practically devoted all his life to that work. Few men in the country have a larger acquaintance among those concerned in this branch of business. Though a young man, he had been very successful, and under his presidency a comparatively new corporation had secured large contracts for work in various cities and sections. His death was very sudden and unexpected and will be a heavy blow to the members of his family and a large circle of friends. He was a man of exceptional ability, a recognized authority in his specialty and possessed of those personal traits and characteristics which win and hold friends."

"Civic News" of Grand Rapids

"CIVIC NEWS" is the name of a new municipal newspaper just started in Grand Rapids, Mich. It is published by the Civic News Company, incorporated under the laws of the State of Michigan, with Delos F. Wilcox, secretary and treasurer, occupying the editorial chair. As Professor Wilcox remarks in his forework: "'Civic News' is based on the idea that better and more efficient local government can be obtained in the long run only through the intelligence and active public interest of large numbers of citizens. Government in this country is, at least in theory, based on the will of the people. We believe that the ideals of freedom and the universal participation of men in the affairs of State should not be set aside. A city is a great co-operative community; its strength and prosperity depend upon the health and happiness of the masses of its people. Its municipal activities are undertaken for their sake. Every man and every family have a vital interest in the conduct of municipal affairs. * * * The aim of 'Civic News' will be to be useful to the people, to be an organ for the discussion of public questions and to bring the affairs of the city and county government nearer home to the average citizen. Its columns are open to everyone who may have a contribution to make on any of the questions that fall within its scope."

This is the third periodical that has been started during Professor Wilcox's brief sojourn in the city of Grand Rapids, all of which have had the best interests of the community at heart and contributed efficient service to the causes espoused. Why their publication was discontinued has never been made known. It is to be hoped that the life of "Civic News" will be much longer than that of its predecessors. Volume 1, Number 1 has a healthy appearance, and it gives every promise of being able to attain its high purpose. Such a weekly newspaper published in every large city, if properly conducted, could not fail to be of great benefit in the efficient conduct of city affairs. THE MUNICIPAL JOURNAL wishes "Civic News" a long and proseprous career.

Editorial Comment

THE good people of Philadelphia are much concerned about the conduct of affairs in that city, and for want of a better excuse are taking it out on Mayor Weaver. Five hundred ministers and many hundreds of citizens recently met in churches and public places of that city during certain hours of a given day to pray that the "social evil" of the city might be abolished. The citizens seem to have a poor opinion of Mayor Weaver, as they contemptuously refer to him as "Sinful John." It is our opinion that the City of "Brotherly Love" would stand a better chance of being "turned from the error of its ways" if the hundreds or thousands, as the case may be, of people who are engaged in so vigorously criticizing Mayor Weaver, would devote a little of their time to introspection for the purpose of ascertaining whether they themselves are guilty of the infraction of any law governing their community. Philadelphia can rightfully be called the worst ruled city in the world, but we do not believe that Mayor Weaver is to blame; the fault lies at the doors of its self-satisfied, contented, respectable citizens.

THE Rapid Transit Board of New York City is planning for the construction of subways and elevated railroads which will cost in round numbers about $250,000,000. This really means that the transportation companies now doing business in Greater New York and other favored capitalists will be profited for many years to come by the use of privileges which belong to the people as a whole, given to the favored few for the price of a song. If the powers that rule New York City would discharge their duties faithfully and give to its citizens as good government as that found in foreign cities, where the rights of the people are not supposed to be respected, there would be some hope for the immediate dawn of a better day. The day of the people is bound to come sometime, but it is a long way removed. "Every dog has his day," and this is the day of the corporation. The people's turn will come later; but it is bound to come. Then New York will have a 3-cent fare, 50-cent gas, 8-cent electricity and many other privileges of which it is ignorant to-day.

MANY of the readers of THE MUNICIPAL JOURNAL AND ENGINEER will be interested to know that Mr. J. M. Diven, the popular secretary of the American Water Works Association has secured the position of superintendent of the new water works at Charleston, S. C., at which place he should be addressed in the future. Fortunately, for the welfare of that association, his change of residence will in no way interfere with the duties of his office of secretary. Mr. Diven is planning for the greatest convention the association has ever held, which will convene at West Baden, Ind. The program is already well under way.

IT is to be regretted that Mr. G. A. Parker, one of the vice-presidents of the American Civic Association, who is in charge of the park department, is obliged to discontinue the publication of his "Items of Park News." In the last number Mr. Parker states: "Hereafter the 'Items of Park News' will be sent out at irregular periods, as time and means allow, probably not oftener than once in three or four months." These park bulletins have contained much interesting information about the opening of new and the development of old parks. If the members of the association will send the items of news to THE MUNICIPAL JOURNAL, it will be very glad to publish them.

INCREASED loss by fire is a direct effect from overhead wires in the business section of any city, town or village. At a recent large fire on High Street, Columbus, Ohio, the firemen were much hindered by overhead wires in their efforts to save property. There was a perfect network of wires in front of the burning buildings, and a local newspaper makes the statement that the loss was much greater than it would have been had there been no wires to interfere with the work of the fire department. Mayor Jeffrey could not perform a more timely service than to compel all the companies operating wires above ground in the business section of his city to put them underground. More than a hundred cities in the United States have already commenced this work. It is time for Columbus to fall in line.

"It costs money to pump water, and naturally when more is wasted than used the people will either be compelled to pay high rates for their water or the plant's receipts will fall below expenditures. It is the duty of every citizen to see that these wastes are stopped." This pertinent remark was made in a recent issue of the Duluth (Minn.) *Herald.*

The best way to prevent the wasting of water is to install water meters throughout the system. It has been repeatedly demonstrated to have a salutary effect in this direction. The experience of the thrifty cities of New England is one which such wasteful cities as Buffalo, Cleveland, Detroit, New York, Philadelphia and many others should profit by.

Catalogues Wanted by a Panama Contractor

Bocas Del Toro, Panama, Jan. 27, 1905.

Editor, Municipal Journal and Engineer:

If advertising with you brings such returns as followed my request for catalogues, yours must be one of the best "mediums." When I reached Panama recently I found a small room pretty well filled with catalogues and accompanying letters.

A great many of the catalogues related to machinery for which I have no use, and which there is little chance of using in this part of the world, and some catalogues mentioned in the letters never came to hand.

As I am still in want of many things, I am going to trespass on your valuable space with a description of the work we have contracted for, and shall be glad to receive from your advertisers suggestions of how their machinery or inventions can be applied to the work. All communications and *catalogues should be sent to me at Bocas del Toro, Republic of Panama.*

I would say, also, that as it takes at the least time three weeks to send a letter to the United States and get a reply it is very important that prices and discounts accompany the catalogues. I have several times been compelled to send for what I believed to be an inferior article, simply because I knew its price and did not know and could not wait to find out the price of the new article.

The contract we have made with the government of Panama calls for the raising of the level of the city about one meter (39.28 inches), laying out of streets, laying sewers, constructing gutters and connecting same with sewers, excavating a drainage canal, constructing two bridges of reinforced concrete over same and building a sea wall. For this the government pays us $241,000.

As the city was almost destroyed last spring by fire, it has been necessary for us to build a warehouse, construct a dock and even a residence for myself, there being nothing to rent at any price.

Most of the filling will be done by using sand from the bottom of the bay that surrounds the city; the final six inches, however, will be of earth and gravel taken from an island not far away. For this I propose to use a belt conveyor which will load the dirt onto scows, then to be towed to our dock where will be installed a crane with hoisting engine by means of which the dirt will be disposed of in Decanville cars. The cars will be hauled about the city by mules. We have three miles of track and twenty-five dump cars for this purpose.

When this contract is well under way we will begin the work of building an aqueduct to bring water to the city. This we shall build of reinforced concrete. The water will come to the city by gravity, but will then be pumped into a stand pipe or reservoir to give sufficient head for fire purposes.

The machinery at the pumping plant will be planned to operate pumps such time as may be needed during the day, and at night run electric apparatus for furnishing electric light for the city.

For power at the pumping plant I think we shall use steam, firing the boilers by using crude oil burners. Coal costs $8 a ton, while Texas oil can be brought here reasonably. I shall be glad to have suggestions from your readers on this point, and especially I shall be glad to get catalogues and circulars regarding oil burners and oil-burning engines.

Howard Egleston.

Personalities

—Mr. Harry E. Blake has been appointed city engineer of North Adams, Mass. He was graduated from Cornell University in 1873.

—Mayor Thomas H. Carr, of Montgomery, Ala., has been in declining health for some time, and has gone to Chicago for specialist treatment.

—Mr. D. W. Pike has resigned as city engineer of Kansas City to resume his connection with his firm of civil engnieers. Mr. E. A. Harper is to be his successor.

—Major Villiers Sankey has resigned his position as city engineer of Toronto, Can., and has accepted one on the engineering staff of the Grand Trunk Pacific Railroad.

Mayor William S. Charles, of Hornellsville, N. Y., was married in New York City on Feb. 4. Captain Charles is one of the best known National Guardsmen in the State.

—Mr. Charles W. Ehlers has been appointed superintendent of Bureau of Engineering and Surveys, of Allegheny City, Pa., to fill the position made vacant by the death of his father.

—Mr. I. M. De Varona, chief engineer of the Department of Water Supply, Gas and Electricity of Brooklyn, has been appointed acting chief engineer of Water Supply Department of New York City.

—Mayor Finch, of Toledo, Ohio, has been under a physician's care for some time, and is now confined to his home. His trouble is acute indigestion, and has become so serious that his friends are doubtful of its relief.

—Mr. Walter McCulloh, M. Am. Soc. C. E., has retired from the position of city engineer of Niagara Falls, N. Y., and will devote his time to his private engineering practice. He has been city engineer since April, 1902.

—Mr. William P. Richards has been appointed surveyor of the District of Columbia, as successor to the late Henry B. Looker. Mr. Richards is a graduate of Lehigh University and has been doing government engineering for some years.

—Mayor Mulvihill, of Bridgeport, Conn., has requested a reduction of his salary from $3,000 to $2,000 a year, and is subject to much criticism on this score, especially as his term of office is nearing its close, and the proposition is regarded either as a bargain offer for a re-election or as a hit at his successor.

—Ex-Mayor McCue, of Charlottesville, Va., was executed at that city on Feb. 10, for the murder of his wife. Every possible effort that money, influence and sympathy could bring to bear was marshalled in his behalf, but justice was inexorable, and he finally made a confession and admitted that the verdict was righteous and the penalty was merited.

—Mayor Thomas Sharp, of Winnepeg, has been in New York recently investigating methods for the proposed improvement of the sewerage system, and enlarging the water plant, an agitation for these improvements having started from a typhoid epidemic in the city. He was accompanied on his return by Mr. Allen Hazen, the expert on these subjects.

—Mayor William T. Haviland, of Bellefontaine, Ohio, has ordered the city solicitor to bring suit against him to recover the fee he has retained for services as judge of the police court. The case is in the nature of a test to determine whether mayors are entitled to such fees and the decision will be awaited with interest as to whether Mayor Haviland or Judge Haviland wins against his other official self.

—The following city engineers have been elected or re-elected: Francis P. Cobb, Chicopee, Mass.; A. K. Crowell, Taunton, Mass.; Charles N. Wood, Norwalk, Conn.; Edward J. Johnson, Nashua, N. H.; Joseph H. Young, Fulton, N. Y.; W. H. Luster, Jr., Elizabeth, N. J.; W. H. Lawton, Newport, R. I.; James L. Tighe, Holyoke, Mass., Charles R. Felton, Brockton, Mass.; Winslow L. Webber, Gloucester, Mass.; Philip D. Borden, Fall River, Mass.

—A novel defense in suit for breach of promise is made by Mayor James E. Zook, of Ballard, Wash. Admitting all the important allegations of the plaintiff, he asserts that his financee has contracted consumption and he has spent a considerable sum in endeavors to improve her health, including sending her on a trip to Arizona for change of climate, the physicians have declared her malady incurable, and he has broken the engagement as a duty to humanity.

—Mr. Emmett Smith, who has held the position of city engineer in Jamestown for most of the time since 1869, has resigned his position, and will be succeeded by Mr. F. W. Dalrymple. Mayor Johnson wished Mr. Smtih to devote his entire time to the city on an annual salary of $8,00, from which he must pay all help and running expenses of the office. Mr. Dalrymple will have a salary of $3,000 and the city will foot the bills for assistants and materials.

—Opposing a proposition to reduce the number of councilmen in Tacoma, Wash., from two to one representative for each ward, Mayor Wright says: "The salary of the councilmen is not sufficient to warrant them devoting their time merely for the consideration, and it is not intended to be. I believe the best results are to be obtained under the theory that the office of council is an honorary position. If the number of councilmen is reduced the representation of citizens is accordingly decreased."

—Hon. C. F. Christensen has resigned the office of mayor for Bells, Texas, to accept the position of cashier of the bank at Ravenna. C. F. Spencer has been appointed his successor.

—The friends of Hon. Wm. C. Crolius, mayor of Joliet, Ill., and president of the League of American Municipalities, will sympathize with him in the recent loss of his youngest daughter by typhoid fever. Mr. Croilus was on the programme for an address on "Problems of Municipal Government in Illinois," to be delivered before the seventh annual convention of the League of Michigan Municipalities at Ionia, Mich., on February 1st.

—Mr. Henry T. Budd, state commissioner of public roads of New Jersey, died at his home in Mount Holly, N. J., on January 14. Mr. Budd was born in 1836, on a farm in West Jersey which had been owned by the family for 225 years. He was through life prominently identified with agriculture, and was appointed state road commissioner in 1895. His present term of office would have expired this year. Under his direction, New Jersey has been placed in front rank of good roads states, and over 1,000 miles of permanent stone and gravel roads in the state are an enduring monument to his official energy and intelligence.

—Mr. William Pierson Judson, formerly Deputy State Engineer of New York, has opened an office for the work of a consulting engineer with a temporary address for 1905 at Broadalbin, Fulton County, N. Y. The readers of THE MUNICIPAL JOURNAL know Mr. Judson as an engineer of national reputation. He is prepared to make special examinations, plans and estimates with view to obtaining best efficiency of works in progress covering the following fields: Harbors, rivers, canals, including breakwaters, piers, wharves, channels, submerged rock excavation, shore protection, locks, dams; concrete constructions, water supplies, sewerage systems; power developments, including hydraulic and electric; roads and pavements, including materials and methods used. He is also prepared to collaborate with specialists. He is a recognized expert in the preparation of reports, prospectuses, and specifications. His permanent address is Oswego, N. Y.

—The unveiling of a portrait of the late Mayor McLane in the city council chambers at Baltimore was occasion for a heart-tribute to the memory of a friend by City Solicitor W. Cobalt Bruce. "I admired his fresh, vivid personality, his private character, his public virtues, his mental gifts," said Mr. Bruce, and added: "I shall always believe that his brief administration sensibly promoted the attainment of those higher municipal ideals which, struggle as the traditional reluctance of artificial party interests may, will sooner or later become the actual working principles of our city government." The tribute is, throughout, discriminating but generous, and treats of the period of the great fire, when popular clamor might have swayed a weaker man to measures less suggestive of the reconstructive powers of American genius with penetrating consideration. The portrait, which takes its place with others of the city's magistrates, was painted by Clinton Peters, a local artist of more than local reputation.

—Mayor E. W. Sorber, of Gowrie, Iowa, issued a proclamation during 1904 which brought his name into notice in all the papers of the land. It was to the effect that he would impose a fine of not less than $5 or more than $20 on any person refusing an offer of marriage during that leap year who resided under his jurisdiction, the proceeds of the fines to go to the public library fund. The mayor happened to be a widower and the wealthiest man of the town, and on

New Year's day the library committee called on him with proof that he had refused ten offers from widows and old maids, and therefore should mulct himself $200. He pleaded for a few days of grace and has now saved being fined by his own ordinance, and a pretty romance has been developed. Years ago he met a young woman with whom he fell in love, but they separated and had lost trace of each other until she saw his proclamation in the public press, when she wrote him a jesting letter which opened the way for a renewal of their friendship, which has resulted in so happily saving him from fining himself $200.

American Society of Municipal Improvements

A. Prescott Folwell, President, ... Easton, Pa.
George W. Tillson, Secretary, . . . Municipal Building, Brooklyn, N. Y.

The American Society of Municipal Improvements, like several other of the most successful technical and semi-technical societies, has provided in its constitution for two classes of members, corporate and associate; the former being advisers or supervisors of municipal work, the latter those who are interested in recommending goods to the former. Only corporate members can vote or hold office. Last month an attempt was made to give some idea of the kinds of information presented in the papers read at the meetings and the methods of obtaining them. But the associate members also possess valuable information which the society can profit by. Many if not most men, when they pick up a magazine or technical periodical, turn first to the advertising pages, because these are frequently more interesting to them than the stories or articles; and there is every reason why, if properly presented, the information which the associate members give with an eye to business should be of great value to the corporate members. In fact, papers which have been presented by associate members have almost always been discussed more freely,—an indication of the interest taken in them—than almost any other at the meeting.

It is proposed to attempt to develop this mutual benefit to a greater degree at Montreal than has been done at any previous meeting, without permitting it to interfere at all with the reading and discussion of papers by corporate members. To effect this a room or rooms will be provided adjacent to that in which the meetings are held, and in these a municipal exhibit will be arranged by the associate members, who are all requested to do their best to interest the society in their goods in this way. Every member is interested to know of the latest and best things in roadmaking machinery, road materials, street-cleaning apparatus, sewer excavators and materials, water-works appliances, garbage collectors and destructors, underground conduits, street lighting appliances, and scores of other articles. On the other hand, the manufacturers, instead of sending agents all over the country with plans and models, can have the most progressive municipal officials of the country come to them here, and come, not with preoccupied minds and only anxious to get rid of the agent, but with minds free and disposed to learn all they can from whomever they can. And, as the exhibit is stationary, it need not consist of models only, but the goods themselves can be shown in a much more satisfactory way. No charge is made to associate members for a moderate amount of space. Goods can be sent from the United States for exhibition without payment of duty, as the exhibition building will be made a bonded warehouse. Associate members who are unable to attend the meeting may send advertising matter, framed photographs, models, etc., and these will be displayed, the only charge being the actual cost of receiving, arranging, and returning them.

It seems hardly possible that any official with receptive mind can attend such a meeting and not learn much that is new and valuable in both the methods and materials in use in municipalities throughout the country.

Pike's Peak Polytechnic Society

This society is composed of civil engineers and surveyors, mining engineers, mechanical engineers, electrical engineers, architects, irrigation and forestry engineers, geologists, assayers, chemists and others who are studying or practicing along technical lines.

Its object is the promotion of intercourse, observation and records in technical subjects, by means of periodical meetings, reading of papers, discussions, special investigation into matters of public and technical interest, the publication of such parts of the proceedings as should be deemed expedient, providing the convenience of a library and reading room for its members and the collection of books and periodicals on technical subjects. It is also the intention to secure the services of prominent specialists in various technical branches represented by the society, to lecture before the members of the society and invited guests.

The regular meetings are held on the second Saturday of each month in the society's rooms in Coburn Library on the Colorado College campus. The annual dues for resident members are $5 and for non-resident members, $3. There are at present eighty members in good standing. The following officers will serve for the year 1905:

President, William Strieby; vice-presidents, B. H. Bryant, L. E. Curtis, W. F. Douglas; recording secretary, E. A. Sawyer; corresponding secretary, W. D. Waltman; treasurer, Ira A. Miller.

Many Cities Putting Wires Underground

As a result of the February storm, during which poles and trees were blown down and live wires scattered in the streets of Atlanta, Ga., the electric railway company was ordered by the authorities to shut off the current on their line, and the electric lighting company was also ordered to turn off their power. The danger to life and from fires under the conditions is a strong argument for placing all wires underground.

In Chester, Pa., a company has been formed, and all of the stock subscribed, for the purpose of placing electrical wires in underground conduits. Work on installing the system will be begun as soon as necessary authority can be obtained from the State legislature.

The Cincinnati and Suburban Telephone Company is preparing to spend $250,000 in extending its system of underground conduits. The plans include a large amount of terri-

tory not already equipped with ducts and will mean the honeycombing of practically every street approaching the city.

The Merchants' Exchange of Oakland, Cal., has submitted to the City Council an ordinance which provides for placing all existing wires in the business portion of the city underground. A period of three years is granted the companies in which to comply with the regulation.

The Albany, N. Y., Common Council is considering an ordinance providing for the placing of wires in certain sections of the city underground. The National Board of Underwriters recently scored the city for the danger entailed in a network of overhead wires, and the suggestion is producing results.

Municipal Lighting Grows in Favor

THE future municipal historian will note of the present era the radical movement for municipal ownership, especially in the matter of public lighting. Within the past few years cities and towns in America and Europe have been building their own electrical plants, and as most are proving successful ventures, the pace is accelerating. During the past month, the press records that many places are preparing to install municipal plants.

Memphis, Tenn., is considering the granting of a franchise to a private company on a guarantee of a reduction of rates both to the city and to the consumer—arc lights to cost from $65 to $72.50 according to the number used—and reserving the privilege to purchase the plant.

Leavenworth, Kans., is now paying a sum equal to the interest on $200,000 for its lights, and for that amount it could install its own plant and earn a profit on the sale of its surplus output.

A bill is before the New Jersey legislature to enable towns and cities of the State to acquire lighting plants.

Rome, Ga., is asking the State legislature for authority to establish and operate a $20,000 electric plant.

Covington, Ky., has alternate propositions under consideration by either of which it is estimated that it will secure arc lights at a cost of $75.00 per year.

Tekamah, Neb., is to vote on a proposition for building a $10,000 plant to be operated in connection with the city water works.

Lorain, Ohio, outraged by excessive charges, has called for estimates for a municipal lighting plant.

Puyallup, Wash., is in trouble with the local company and may resolve to go into business on its own score.

Mayor Finch, of Toledo, Ohio, asserts that the time has come when "the city ought to ascertai nwhat it costs to put up a plant, and what the probable cost would be for lighting the city. I believe it can do this, and very accurately, too, and it ought to be done right away."

McKeesport, Pa., is in a wrangle with the local lighting company, which may result in municipal ownership.

Knoxville, Tenn., has a bill pending in the State legislature authorizing it to own its own electric lighting plant. The figures of the Nashville plant for 1904 are being used to urge the passage of the bill. The cost of operating and maintaining the plant, including interest on bonds, depreciation and all other expenses, was $38,000; the output in kilowatts was equal to 1,150 arc lights. Prior to city ownership Nashville had 383 arc lights, for which it paid $55,000.

Muncie, Ind., is another city facing the inevitable through excessive charges and inferior service by a private company.

At a recent meeting of the Hamilton, Canada, Board of Works, the city engineer was ordered to make a report in the matter of lighting the streets by a city plant.

Method for Cleaning Bitulithic Pavement

So much of the bitulithic pavement has been laid within the last few years that the question as to the best methods for cleaning the pavement has been discussed by many street cleaning superintendents. For the benefit of street cleaning departments throughout the country, THE MUNICIPAL JOURNAL gives the following experience of C. F. Lawson, Superintendent of the Street Department of New Bedford, Mass.:

"For some time I have given careful thought as to the best manner of cleaning the bitulithic pavement in our city. During dry weather we have no difficulty in keeping it clean by hand sweeping, but a day or two of wet weather renders this method at best but partially successful, and the surface of the street becomes coated with a slimy, substance, which can only be removed by flushing.

"Until quite recently I have used fire hose attached to hydrants for this purpose, but this method is expensive, and owing to the danger of frightening horses and the interference with traffic it has been necessary to do this work at night.

"I have found that with an ordinary vertical spray sprinkling wagon, such as made by the Eastman Company, of Concord, N. H., this flushing can be done in a most effectual manner. By starting on the crown and opening the valves to their fullest extent, a few trips along the street washes all the filth to the gutter, and the pavement is made absolutely clean. From the quickly moving wagon the water does not strike any one point a sufficient length of time nor with sufficient force to disintegrate the surface in the slightest degree, which I learn is the case with some specially designed flushing machines.

"I have become thoroughly convinced, therefore, that a few vertical spray street sprinklers are the best and only plant required to properly flush the bitulithic pavement, and that this in conjunction with sweeping will keep the pavement in perfectly clean and sanitary condition."

Meters Prevent Water Waste

CITY after city throughout the country is having trouble through the persistent waste of water by the consumer. The average citizen imagines that the only way to prevent pipes from freezing and bursting is to let the water run at the spigo, and that what he wastes will not amount to much if no one else does so, and if every one else follows the same method, then he is in "good company."

In Camden, N. J., the excess in the volume of water used during the recent cold wave was 1,500,000 gallons daily. In Buffalo, N. Y., the per capita consumption has increased from 105 gallons in 1880 to 319 gallons daily in 1904, and other cities show increases to a greater or lesser degree.

Authorities repeatedly call attention to the fact that turning off the water in the cellar is effecive against freezing and is the proper method; that the abnormal waste is a great danger both to health and to property. But warnings seem of no avail.

The only efficient means of control appears to be by the use of meters, as is shown by the statistics of Milwaukee, where with 31,000 meters in use the daily per capita consumption is 104 gallons; an amount that is liberal without being excessive.

The raising of insurance rates; the loss of power to supply one's neighbors on the upper floors; the danger of a water famine; the threat of prosecution for violation of an ordinance, are readily defied, but wheen it comes to paying hard cash for the privilege of wasting water that has been accurately measured through a meter, the consumer hesitates and finds a cheaper remedy in stopping the flow at the cellar.

Waterbury's Garbage Disposal Plant

The disposal of garbage at Waterbury, Conn., by cremation was begun in 1901, when the city made a contract with H. M. Regney for four and one-half years at a cost of $80,000, and on April 1, 1905, the crematory, which is situated at Waterville, three miles from the city, is to become the property of the city together with the collecting wagons now in use. The plant is a Smith's Garbage Crematory, improved by Mr. Regney, the contractor, and was built by the Bridgeport Boiler Works Company. It consists of two furnaces, each supplied with a cradle of pipes; one furnace is filled at a time and the garbage is dried by the heat generated in the other furnace; then the dried garbage in the second furnace is used for fuel and evaporates the water from the fresh garbage in the first furnace. The steam generated is used in creating a draft in the smoke stack, and also for scalding out the carts after the refuse has been dumped and may be used for power purposes. No odor is given off in the process and but a minimum amount of coal is required. The plant has been in successful operation night and day for four years, and last year twenty-seven tons per day of garbage was destroyed at a cost, including collection, of $18,000 for the year. No bi-product is manufactured. The garbage is collected three times a week, and a force of twenty-one men, twenty-five horses and ten wagons is employed.

To Prohibit Fireworks in New York

Chief Edward F. Croker, of the New York City Fire Department, recommends in a letter to Fire Commissioner Nicholas J. Hayes the entire prohibition of the use of fireworks on and around July 4th. Firecrackers are to be exempt for one year for the reason that there are already immense stores in stock and in the process of inportation, and to prohibit their sale on such short notice would be a hardship to the dealer.

The reason for his recommendation is found in the figures for fires and accidents for the week inclusive of the national celebration, which shows, for last year, that of 212 fires in Manhattan and the Bronx, ninety-three were caused by fireworks, in Brooklyn and Queens thirty-four out of seventy-seven fires were traceable to fireworks and out of sixteen fires in Richmond were due to the same cause. That is, of 305 fires, 128, or 42 per cent., were due to the careless use of fireworks. A total of 846 persons were reported injured by explosions—or about the complement of a full regiment of soldiers, which is more than the casualties in any one battle of the war for independence. It is intimated that this is the first step toward the entire prohibition of the use of fireworks in the city.

Facts About Scranton

The city of Scranton, Pa., formed from Providence Hyde Park and Scranton Boroughs and Providence township, was incorporated in 1866, at which time it had a population of 20,000. It has grown to be (1904) the fourth city in population in Pennsylvania and the thirty-eighth in the United States, having a population of 102,026, and an area of 19,255 square miles. Scranton is from 920 to 1,770 feet above tide water; it is connected with the outside world by six railroads; has 149 miles of streets, 19.17 acres in public parks; 32 miles of street railways, and an assessed valuation of $63,379,770.

Mayor's Salary $10 a Year.—At the meeting of Council of the village of Brookside, on Monday night, was passed an ordinance which provides for the salary for the officers, and is as follows: Mayor, $10 per year; Councilmen, $2 per meeting, and the meetings not to exceed more than twenty-four in one year.

Stamford, Conn., will enlarge its boundaries to coincide with those of the town in which it is situated. At present there is a dual government, and as illustration of the cumbrous method of having two sets of officers, the town collects $20,000 yearly for highways and returns $18,000 to the city. The town also controls the schools and bridges, and the town clerk is the Registrar of Deeds and of Vital Statistics. By the proposed change the city government will have entire control.

Garbage Disposal by Connecticut Cities is a subject for severe criticism by the State Board of Health. After stating that of more than fifty cities and boroughs in the State, only a dozen have any public provision for the systematic collection and disposal of garbage, and only Bridgeport and Waterbury dispose of it by cremation, that collections are made but twice or three times a week and are gathered in open carts, moving slowly from house to house, dumping the receptacles, the contents of which have begun to putrefy; and which involve an intolerable stench, the report asks:

"Is it possible to conceive of a more unscientific, unsanitary, and uncivilized and disgusting practice than that followed in the two largest cities in the State for the disposal of its garbage? They and other cities, too, not only gather it as described, but they do worse; they cart it into adjoining towns and feed this mass of rotten, semi-putrid nastiness to swine."

London Now Owns Its Water Supply

THE greatest municipal water enterprise that has ever been undertaken is now completed by the acquisition of the eight private Metropolitan companies by the London Water Board.

That the Board has done its work well is universally admitted, and the question now up to the rate-payer is whether he has a bargain or an elephant—whether he must pay a greater or a lesser tax.

The total of the claims of the eight companies for their several plants, including a demand by seven companies for the loss of interest on their capital pending its re-investment and for the cost of re-investment, estimated at five per cent. of the amount to be received, was £50,939,198, and the total amount of the award in cash was £30,662,323, which was paid by an issue of £33,564,281 of water stock, bearing three per cent. interest.

In addition to the cost of the plants are the expenses of the commission, including the cost of floating the stock, Court of Arbitration costs, stamp duties, etc., amounting to £850,000, which will require, at the average of water stocks, a further issue of £917,266, and making a total of £34,481,587, from which may be deducted the Chamberlain's sinking fund maintained by the companies, and amounting to £200,000, leaving a net total cost of £34,281,547.

The first charge for the expense of conducting the city plant will be £1,028,446 for interest on the stock, and £29,000 for the cost of composition for stamp duty on the stock and cost of management of the stock—a total of £1,057,446.

In the accompanying table, illustrating the business of the several companies for the last year of their individual existence, it will be noted that the total profits over and above the cost of operation of the plants, as shown by the sums paid in dividends, the sums paid into the sinking funds and the sums paid in directors' fees amounted to £1,152,268. Subtracting the expense, as shown above, from this profit leaves a balance of £94,822 to the credit of the city.

The combination of the various plants under one management will doubtless increase this balance through the reduction of expense.

No allowance is made in these figures for the extinction of the stock by means of sinking fund, or otherwise, as the Act of Parliament establishing the Board does not require any such provision for the discharge of the debt during the first twenty years of the 100 years for which it is issued, except as the receipts exceed the expenditures during any one year.

THE WANTON WASTE OF WATER in the city of Buffalo is graphically shown in the following comparative figures with Boston, as compiled by Louis H. Knapp, C. E.:

	Boston.	Buffalo.
Area of square miles	142	40
Population	900,000	360,000
Daily average consumption	107,000,000	117,000,000
Daily average consumption per capita gal	120	325
Number of actual services	140,000	40,000
Number of meters	13,000	1,400
Services metered	9%	3½%
Water metered	40%	15%
Pipe mileage	1,400	500

Boston uses twenty-five gallons and Buffalo thirty-five gallons per capita of water for domestic purposes, including stable use and lawn sprinkling. Boston uses twenty-three and Buffalo fifty gallons per capita for manufacturing and trade purposes. Boston uses seven and Buffalo fifteen gallons per capita for public purposes. In waste, such as to prevent freezing of pipes and flushing of closets and drains, Boston uses forty and Buffalo 200 gallons per capita.

Company.	Amount of Claim.‡	Amount of Award. in cash.	Loan capital issued at the appointed day.					Total.	Income for year 1903-4.	Interest paid on loan capital in 1903-4.	Dividends paid on share capital in 1903-4.	Payments to Chamberlain's Sinking Fund in 1903-4.	Directors' fees, 1903-4.
			Debenture Stocks.			Mortgages.							
			Rate of interest	Redeemable.	Irredeemable.	Rate of interest	Amount						
	£	£	%	£	£	%	£	£	£	£	£	£	£
East London	7,204,144	3,900,000	4½	(Free of income tax)	654,740			2,251,166	404,876	75,465	141,221	5,543	3,347
			3	1,596,426									
New River	13,260,144	5,967,123*	4		1,500,000			2,758,000	614,742	86,075	236,308	9,430	11,091
			3	1,258,000									
Grand Junction	4,830,000	3,349,500	4		325,000			500,250	249,296	12,928	107,760	—	2,615
			3	75,250									
			3½	100,000									
West Middlesex	4,200,240	3,524,000	4½		200,000			772,000	298,361	25,830	120,755	10,270	3,776
			3	572,000									
Lambeth	5,511,342	4,301,000†	4		350,000			1,045,753	325,366	31,212	147,351	9,404	3,451
			3	695,753									
Southwark and Vauxhall	5,674,140	3,603,000	4		1,019,585			2,487,982	294,872	65,545	93,158	2,721	3,162
			3	1,468,397									
Chelsea	4,750,000	3,305,700	4½		175,785			249,217	179,260	9,988	105,440	2,134	2,096
			2¾	49,950									
			3	23,482									
Kent	3,715,614	2,712,000	4½		100,000	3½	42,000	333,880	220,316	10,747	127,087	1,150	3,000
			5		40,000								
			3	151,880									
Staines Reservoirs Joint Committee	—	—	3	1,226,700				1,226,700	—	36,105	—	—	—
5 per cent. on claims other than New River Company‡	49,145,624 1,794,274												
Total	50,939,198	30,662,323		7,217,838	4,365,110		42,000	11,624,948	2,587,089	353,895	1,079,078	40,652	32,538

‡ NOTE.—Except in the case of the New River Company, each of the Companies claimed in addition a sum equal to 5 per cent. of its claim, or the amount of the Award, for possible loss of interest pending re-investment and for the costs of re-investment. In each of such cases, the Award included a certain amount in respect of this claim.

* NOTE.—The Award in the case of the New River Company amounts to £6,534,030 Water Stock, but the figure of £5,967,123 is the cash equivalent, taking as the basis of calculation the price at which the agreement to take stock in lieu of cash was arrived at with the other Companies.

† NOTE.—Under the Award the Lambeth Company had to pay the Board the sum of £42,678, in respect of the repair of a culvert.

Savannah's Old and New City Hall

THE new City Hall of Savannah, Ga., is about ready for occupancy, and is, perhaps, unique among municipal buildings, in that its total cost, amounting to $250,000 will be paid from the current income of the city for 1904-05 without the issuing of a single bond, note or other obligation of any kind, and without the levying of any special tax.

The new building stands on a bluff facing the foot of Bull street, the rear overlooking the river. It is six stories high, though two stories in the rear are not seen in the cut, and the exterior is of Georgia granite. It occupies the site of the old City Building, or Exchange, as it was called, which was one of the historic buildings of the South, and the oldest brick building in the State, the corner stone having been laid in 1799. It will, therefore, preserve in a measure the memories of more than a century which cluster around the spot.

OLD CITY HALL AT SAVANNAH

In the methods of building the two structures is seen the contrast between the caution of poverty of the early 19th century and the bold confidence of wealth of the 20th century. The old building was at first designed as a public Exchange to accommodate private as well as public business, and was built by an issue of stock—200 shares at $100 face value each—the city subscribing twenty-five shares. The first assessment on the stock was for $15 per share; the second called for $30; the third for $45, and other calls until each share had actually paid in $156.

The city built the steeple and bought the clock and bell at an expense of $2,139.06, a cost that, in the relative power to pay, would equal more than $40,000 today.

By 1806 the city had become the owner of sixty-five shares of the stock, and its holdings were gradually until, in 1812, it became the sole owner of the building. On account of changes in the building the Council did not occupy permanent quarters before 1815, and the Mayor's offices were not set off until 1853.

During the early period portions of the building were variously used for Postoffice, Customs offices, Port Wardens and for private business, and the old Georgian newspaper office, which introduced the first steam printing press into the State, was domiciled here for many years. Pedagogues had school rooms in the building; and traveling actors and showmen, with their menageries, found show space within its walls. The great "long room" was also a place for showing human lions, and grand receptions were given to Aaron Burr, Presidents Munroe, Polk and Fillmore, General Lafayette, Henry Clay, Daniel Webster and others of the great men of the young Republic.

It is the swell dancing hall, too, and on the higher floors the local military companies, as the Savannah Volunteer Guards, Republican Blues, Georgia Hussars and Phoenix Rifles and others were given drill room, which prepared many brave men for the greatest military conflict of the ages. And, with the dancing and banqueting and show seeing; with the public, a free press, and the preparations for war, there was a more somber use for the place when the city's honored dead were laid in state under its roof. It is well that in its site these memories are preserved by the new building, and may its history be saturated with as marvelous achievement.

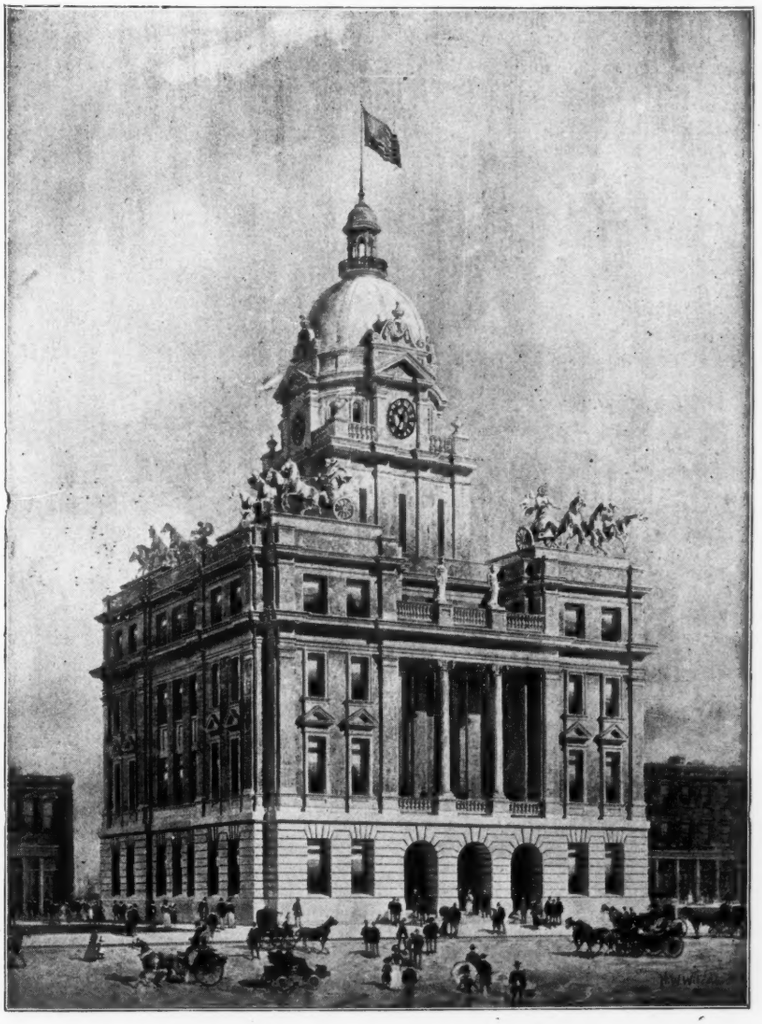
MUNICIPAL LIGHTING IS SUCCESSFUL at South Norwalk, Conn., as is shown by the fact that the city plant has paid expenses ever since its installation; it has already been enlarged twice, and the demand is again up to the station capacity so that a new and larger plant is to be built, and it sells electricity for lighting and power at a price 60 per cent. lower than the private company.

The Future of Rapid Transit in New York

PRESIDENT ELIOT, of Harvard, has recently asserted that our present time civilization is building nothing that will endure for the enlightenment of the archeologist of 3,905 A. D., except our subways. That being true, the aforesaid student of 2,000 years hence will doubtless imagine that the earth of this period had its equator at City Hall, New York.

In addition to the subway already in operation, and which cost $35,000,000, there is now under way and projected, the Pennsylvania Railroad tunnel and terminal to cost $50,000,000; other Hudson River tunnels to cost $30,000,000; East River tunnels to cost $20,000,000, and subway plans recommended to cost $49,000,000, to which may be added to complete the cost of proposed rapid transit plans, the improvements to be made by the New York Central, the New York, New Haven & Hartford, and the Erie railroads, and the Manhattan, Williamsburg and Blackwell's Island bridges, making a grand total cost of $265,000,000.

This is certainly an enormous amount of money, but when it is recalled that the cost of building the Erie Canal, estimated by the power to pay, would have equalled an investment of $700,000,000 at the present time, it indicates that our grandfathers were also ready to take risks.



NEW CITY HALL AT SAVANNAH

The plans submitted by Chief Engineer Parsons to the Rapid Transit Commission of New York propose a new East Side line from the Battery to One Hundred and Forty-ninth street, in the Bronx, with a double-decker subway through Lexington avenue. A new West Side line from the Battery to Forty-second street, connecting with the present line. A crosstown connection at Thiry-fourth street, between Seventh and Park avenues. A tunnel connecting with the new West side line with a low level loop at Barclay street; thence to the Battery; under East River to Governor's Island; under Buttermilk channel to Hamilton avenue, Brooklyn; thence to Fort Hamilton.

In the Bronx, Mr. Parsons proposes an extension of the present West side line from Kingsbridge to Van Cortlandt Park, and an extension of the present East side line from One Hundred and Eightieth street, under Bronx Park, to the city line. And he further recommends the continuation of the "L" road from One Hunderd and Fifty-fifth street, on the West side, across Harlem River, to Woodlawn; the building of tracks for express trains on Second avenue, and an extension of the Brooklyn Elevated lines.

Another proposition before the Rapid Transit Commission is for two tunnels, each about twenty feet wide, under Thirty-fourth street, and each to be equipped with moving sidewalks of six feet in width. The first on which the passenger steps will be moving at the rate of three miles an hour; the second at six miles, and third at nine miles. The grading of the speed will enable passengers to step from one to the other without shock, and the project will afford crosstown connection at one of the congested points.

Another request before the Rapid Transit Commission is from the owners of the new Trinity Building to extend the station at Rector street 200 feet north under the sidewalk in front of Trinity Church graveyard, so that the building can have an entrance to the subway—the cost to be paid by the private owners. This proposition forecasts the time when "all the modern improvements" will include with bath, etc., an entrance from the cellar to the subway.

The limit of growth of a city has been theoretically stated to be a limit of one hour to or from business, and while New York grows in sky line fifty feet in a decade the widening of its limits is growing with underground transportation, and twenty years hence it will lead the world in population.

—Edward B. Ellicott, city electrician of Chicago, Ill., was loaned to New York to aid in an investigation started by Comptroller Grout into the alleged exorbitant gas and electric light bills.

INCIDENTAL ITEMS OF INTEREST

Many Matters of Moment to Municipalities Briefly Told---Short Record of Happenings and Facts in City, Town and Village

Municipal Light in Logan City.—According to a preliminary report of the superintendent of the Logan City, Utah, electric lighting plant, covering the period from May 1 to Dec. 31, 1904, the plant is supplying 3,750 lights, 500 of which are street lights. The operating expenses have been $3,749.21, and the earnings $10,855.35, leaving the net earnings for eight months $7,106.14. The total cost of the plant is given at $99,495.98.

The Nashville, Tenn., City Light Plant, for 1904, cost a total for operating expenses of $32,667.86, and there was expended for additional equipment during the year $17,700.71, making a grand total of $50,368.57. There are now in service 726 arc lamps and 2,331 incandescents, the numbers having been increased by 84 and 448 respectively during the year. Two 36 horse-power alternating motors were installed, in 1904, for driving rock crushers, and have proven very satisfactory.

The Underground Conduit System of New Britain, Conn., was at a standstill during the last year, owing to legislative restriction, and will continue to be held up until the city charter can be amended. During the year 41 feet 3 inches of lateral duct; 118 feet 6 inches of telephone duct, and 280 feet 6 inches of high potential duct were added. The total receipts were $11,858, and expenses $1,739. It is expected that all wires in the subway district will soon be underground.

Oiled Roads of California.—California is experimenting extinsively with oiled roads, and the State now has 2,200 miles of roads and 552 miles of streets, besides 1,100 miles of railroad tracks treated in this way. In the beginning oil was used to lay the dust as a cheap substitute for sprinkling with water, and the hardening of the surface obtained, together with its lasting quality, has lead road makers to use it in making permanent road surfacing.

In the use of oil strict adherence to certain good-road principles is necessary, and careful work should be had in the preparation of the road to be treated. If an earth foundation is to be dealt with, it should be worked until a uniform density is obtained, and in case of macadam or gravel roads they should be free from weak spots. An equal distribution and a liberal sanding, to hold the oil in place on the crowned surface, is also necessary.

The oil used varies in gravity from 12 to 18 degrees, and contains from 40 to 50 per cent. asphalt. It may be heated or used cold, and the cost per mile averages about $25.

Overhanging trees have been found detrimental to oiled roads, and chuck holes are a perpetual annoyance in maintaining a road.

The Relative Cost of Macadam in Middletown, N. Y., has averaged, for 1900, $0.471 per square yard; for 1901, $0.41; for 1902, $0.466, and for 1903, $0.493. Itemized, the figures for 1903 show that 11,240 square yards were laid, the depth of stone being eight inches; the cost of macadam ranged from 47 cents to 61 cents per square yard; the cost of grading averaged about eight cents per square yard; the length in feet was 4,334.4, and the width between curbs varied from twenty feet to thirty feet, the cost per lineal foot ranging from $1.41 to $1.56.

Norwalk, Conn., Water Works have a reservoir capacity of 122,000,000 gallons, and grounds affording an additional capacity of 300,000,000 gallons have been purchased. The daily consumption is 1,750,000 gallons for an estimated population of 7,000. There are two supply pipes, of twelve-inch and sixteen-inch, and forty miles of distributing pipes. In 1893, five miles of sixteen-inch mains were laid at a cost of $70,000, and $10,000 was expended on dams and in enlarging old pipes. $80,000 was raised in 3½ per cent. bonds which sold at par; this is the only debt on the works. The surplus in 1904 was $19,000. Next to New Britain, the water is rated the best in the State.

The Water Supply in Richmond.—The city of Richmond, Va., has owned its water works since 1830, and the total credit balance to January 1, 1903, is 269,572.20. The average daily consumption of water for the city for the year ended Dec. 31, 1902, was 11,246,899 gallons, or 112 gallons per capita. The cost at the new pump-house of pumping a million gallons was $3.65, as against $5.75 at the old pump-house. For bettering the supply of water, subsiding and coagulating basins are being built which, it is believed, will supply clear and wholesome water.

The Wallingford, Conn., Municipal Lighting Plant shows a profit for the year ending July 31, 1904, of $5,881.87, and after charging off five per cent. of the value of the plant for depreciation and five per cent. for profit, there is a balance of $636.88, to be credited to the surplus account. The average cost of manufacture per kilowatt was $0.0447; the street arc lamps are 1,200 c. p., and burned an average of 1,667 hours per lamp during the year, and the rate charged per year per lamp was $69.58, which is a saving to the borough of about $20.00 a year on each lamp. The commercial service has increased during the year 19.6 per cent., and there are 9,600 incandescent lamps served, at a saving of 50 per cent to the consumer, the charge being 10 cents per kilowatt to customers.

SUGGESTIONS TO UNDERWRITERS

A Practical Engineer Concludes That Buildings Can Be Made Fireproof—Lessons of the Baltimore Fire—Structural Features to Be Avoided

*By John R. Freeman**

I HAVE been very much interested in Capt. Sewell's statements regarding the Baltimore fire. I have visited these ruins three times, and spent four days in slowly going through room after room of those fireproof buildings, studying the effects of the heat on different materials, and in the eighteen years that I have been studying matters of fire protection I have never before found so excellent a school in which to study, or so many object lessons for showing what structural features to avoid in the future.

It appears to me that in those buildings one can find ample demonstration that *buildings can be made fireproof;* and that it is really possible to make adequate and certain provision against the exposure hazard. We have shown to us there more clearly than ever before the temperature obtained in a great conflagration. We have building materials of almost every kind tested in their resistance to fire under very nearly the same conditions.

TEMPERATURE OF A CONFLAGRATION

It is of great practical importance to know what the temperature is at great fires, for we can then regulate our testing furnaces to correspond, and this temperature is marked most beautifully in almost every one of those fireproof buildings in Baltimore by the fusing points of various materials.

In the ruins of the non-fireproof buildings, we also find much that is instructive as to the degree of heat. I had the good fortune to inspect these ruins accompanied by one of the leading steel works engineers in the country, a man whose life has largely been spent as superintendent of some of the largest plants in this country, and is, from long practical experience, thoroughly well versed in the effect of heat on metals. It was our general impression arrived at independently that the temperature attained in the non-fireproof buildings, as shown by the radius of the curvature of the bent pieces of steel and wrought iron, and the appearance of much of the wreckage, was, in general, the temperature corresponding to a dull redness; but sometimes a little more than that, where fuel and air currents were favorable, but very rarely reaching the fusion point of the most fusible cast iron, and then only on exposed corners and over areas of a few inches.

In the wrecks of the non-fireproof buildings where fused metals were found, it was impossible to say if this had occurred before the walls and floors fell, or after the damage had been done and while the heat was more concentrated and confined, and the effect more like that of a furnace.

"The 'fireproof' wrecks gave the best opportunity for study. In order to measure this temperature in degrees of the thermometer, I went through building after building with much care, taking specimens of metals that had been partially fused. I was interested particularly in the brass of the electric fixtures. I found that only rarely did the most intense heat of that great conflagration reach the melting point of brass. It is safe to say that out of all the pieces of brass of various kinds, attachments to typewriters, railings and desk ornaments, hinges, locks, door-knobs, safe-handles, electric fixtures, and so on, that very much less than one per cent. of all the brass exposed to the full heat of the fire, in rooms where everything combustible was reduced to ashes, was heated to the point of fusion.

In rooms containing extra large quantities of papers and filing cases like those occupied by the commercial agencies, or the filing rooms of some large offices, I found numerous places where the brass had been fused.

Since the melting point of brass varies with its chemical composition, I brought home specimens, and took them to the Research Laboratory of the Massachusetts Institute of Technology to have the melting temperature of that particular brass measured. In the case of the thin rolled brass of the electroliers, an average specimen, which had been fused at one end only, showed that the extreme heat of the conflagration in the midst of the room from which it was taken was about eighteen hundred degrees Fahrenheit.

By digging around among the ashes, I could occasionally find a brass hinge or a transom fastening of brass that had been fused, but in only a few cases had their fusion point been reached. Those were of soft cast brass, and a representative specimen tested by Prof. Warren in the Technology Laboratories, showed a melting-point of about 1,650 degrees Fahrenheit, as marking the extreme temperature in one of the hottest parts of the conflagration.

From observations at many points about these fireproof buildings, it appears safe to say that the extreme heat seldom exceeded 1,600 to 1,800 degrees, and was commonly less, and as one lesson from the Baltimore fire I should say that 1,700 degrees Fehrenheit maintained for one hour was a fair general standard for the testing furnace of an Underwriters' Laboratory, with about 2,100 degrees as the extreme limit over small areas and for a short time.

Another feature which very distinctly marked the ex-

* Consulting Engineer, Providence, R. I. An address delivered at the Annual Banquet of the National Board of Fire Underwriters at Delmonico's, New York.

treme temperature reached was the melting of the window glass. Throughout the hottest rooms of most of the fireproofed buildings, the window glass had softened enough to bend. In only a comparatively few cases had it melted sufficiently to run freely. I remember one window in the Calvert building where the glass had apparently been heated to the point that it had run over the sill, almost as water would run, and in the *Herald* building a large sheet of wire-glass from the skylight had fallen across a bar, in about the shape that a wet limp cloth would assume.

I brought back, for test, a piece of plate-glass from the hot side of the Union Trust Company building, which had fallen onto the wheel of a copying-press, and draped itself around it in a way that served to show how soft and plastic it had been.

A laboratory measurement of the heat at which that piece of glass became softened, enough to bend in this manner, gave 1,600 degrees Fahrenheit. The same glass became nearly fluid at a little above 1,650 degrees Fahrenheit.

I looked particularly for evidence of the melting of cast iron in these fireproof buildings, and only in two, or possibly three, cases did I find an instance where cast iron had been heated to the fusion point.

There is much difference in the fusing points of different irons and steels according to the percentage of carbon that they contain.

At what had apparently been the hottest place in the Continental Trust Company building, and also at the Calvert building, the corners of a cast-iron radiator had begun to yield, and in the Maryland Trust Company building there was a small corner of a copying-press on which there was also evidence of incipient fusion.

Out of the hundreds of typewriter frames that I noted among the ruins there were in all, perhaps, a half dozen where a little fusion of cast iron was apparent on the corners of the frame, but the great majority, or in nineteen out of twenty of the typewriters, the fusion point of cast iron had not been reached.

A specimen that I brought back, of partly fused cast-iron from a radiator, melted at somewhere between 2,000 and 2,050 degrees Fahrenheit.

FIRE-SHUTTERS

A point which interested me exceedingly, in studying the Baltimore ruins, was to see whether thin wrought iron or steel plate, such as is used for covering fire-shutters, had at any point been heated to a point where its power or resistance was seriously impaired. The ordinary Underwriters' fire-shutter depends for its strength and its resistance upon its thin covering of very soft mild steel coated with tin. I examined thin sheet-steel lamp-shades, thin bands for pipe coverings, tin boxes, filing cases, and dozens of shutters themselves. In no place did I find any indication that metal of that quality had been so softened, or had reached such a heat that it would be seriously impaired for the purpose of fire-shutters, and one of the great lessons that I brought away from the Baltimore fire was that our standard tin covering for the Underwriters' shutter is all right, and that this covering material has sufficient power of resistance to withstand the fiercest heat of a great conflagration, but that we do need to find some better material than pine wood to fill it with. I also made careful examinations of copper in flashings, cornices, etc., to see if it had melted. In a few small spots in rare instances fusion had begun, but in general I found it had ample resistance to fusion, so that it can prudently be used for covering fire-shutters, where something more ornamental or weather-proof than tinned plate is desired and expense is no bar.

The Standard Underwriter Shutter of wood covered with tin did not give a very good account of itself in the Baltimore fire, and I think it can be said, without fear of serious contradiction, that the endurance of the ordinary Underwriters' shutter of tin-clad wood is limited to not more than about half an hour's endurance of a temperature of 1,500 degrees, and that this limit is often passed in the heat of an ordinary conflagration, and that in many of the cases where single doors or shutters have shown up so well there has happened to be an incoming air current that has helped to cool the shutter.

The limitations of the tin-clad wooden shutter were shown at one corner of the burned district in Baltimore. A large shirt factory, whose windows were protected by wooden fire-shutters, had a very close call. By heroic efforts, with private pump and hose streams, the employees saved the factory. I took particular interest in examining those shutters, and although this was not at the hottest part of the fire, I found, in parts of the shutters at the hottest exposure, that the pine wood was charred entirly through and all gone.

This matter of better shutters is one which we should set some of our best talent at work in the experimental way. In your excellent laboratory in Chicago there is excellent apparatus for the needed tests. Although the present shutter and the present approved form of fire-door is all right nine-tenths of the time, and perhaps nineteen-twentieths of the time, it is not all that we need in a great conflagration.

I have said that buildings can be made fireproof against bad exposures. The possibility of making them so is found largely in the development of a superior thin form of fire-shutter, and in educating the architects and owners of buildings toward building a shape of window that is easily protected by the fire-shutter, and a neat window-jamb formed to receive this shutter when folded back *inside the window.*

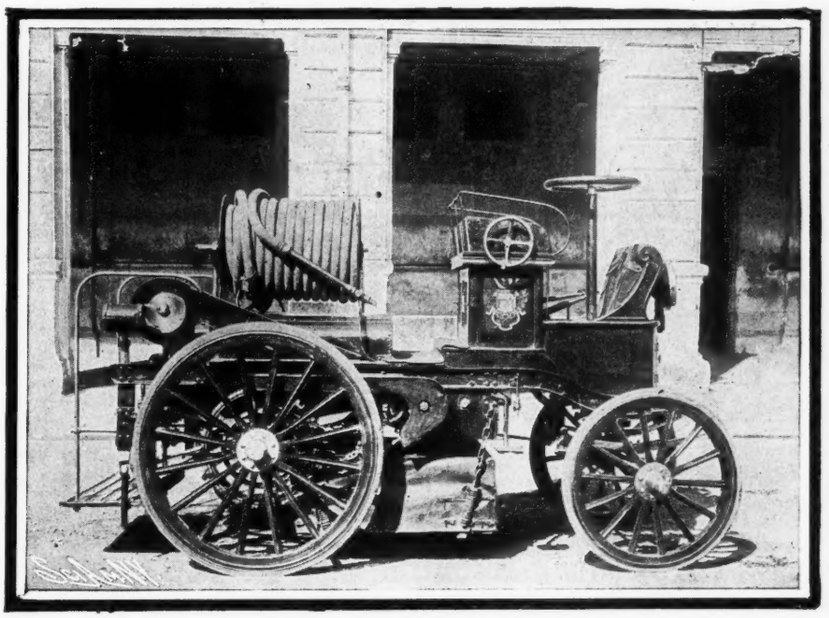
Windows of suitable size for all ordinary office purposes can easily be so designed that they can be protected by fire-shutters, and then the shutters when open and folded back on the inside will not be obtrusive or unsightly. When a bad exposure-fire comes the ruin of the sash and glazing can be paid for cheerfully if the contents of the building are saved.

(To be concluded in April)

AUTOMOBILE FIRE ENGINES USED ABROAD*

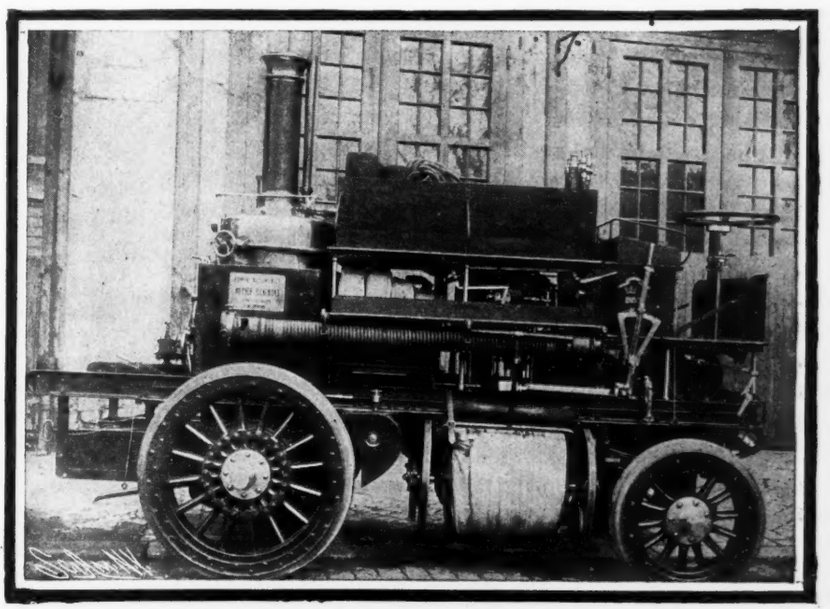
By Emile Guarini

THE WEYHER & RICHEMOND COMPANY, of Patin, Department of the Seine, recently furnished to the fire department of the city of Paris a very interesting automobile steam fire engine. Through the courtesy and personal assistance of Lieutenant-Colonel Vuilquin, of the said fire department, I have been enabled to make a thorough study of the machine. The boiler is of the multi-tubular type, having curvilinear tubes. The working pressure is 10 kilogrammes per square centimeter (142½ pounds per square inch), which is raised almost instantly. The engine is a compound one, with variable cut-off, of about 30 effective horse-power. It makes 300 R. P. M., and may be instantly changed from a compound to a double-cylinder, high-pressure engine, under which conditions it derives more power. This change is found useful in starting and when ascending grades. By the movement of a lever, the motor can be disconnected from the driving wheels and thrown into gear with the pumps, which have a capacity of 1,800 liters (575½ gallons per minute. The engine is geared to a normal speed of 24 wilometers per hour (14.9 miles). The automobile is arranged so as to carry twelve lengths of large hose, six of small hose, four suction pipes, 300 liters (52.84 gallons) of water, 120 kilogrammes (264½ pounds) of coal, twelve men, large and small pipes and hooks and other accessories. The city of Paris also possesses an electric automobile fire engine, an illustration of which is here shown. As will be seen, it consists first of an electric vehicle carrying a pump for extinguishing fires, said pump being at first supplied from a large tun filled with a specially compounded extinguishing liquid. There is, moreover, a reel carrying 40 meters (131¼ feet) of hose. The motor which is used to propel the vehicle serves, when the automobile is at rest, for driving the pump. This system offers the advantage of an immediate departure from the engine house, and, upon arriving at the fire, an equally rapid starting of the pumps, thus realizing an effective attack upon the burning building with much less loss of time than under ordinary methods.



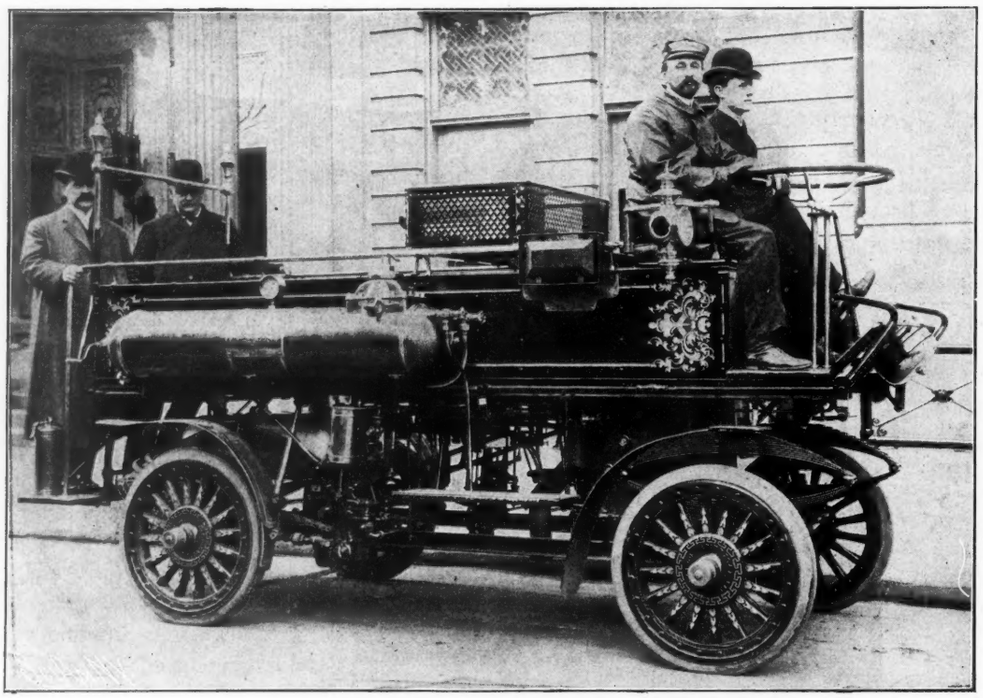
ELECTRIC AUTOMOBILE ENGINE FIRE ENGINE OF THE PARIS FIRE DEPARTMENT*

The electric automobile fire engine weighs about 2,290 kilogrammes (5,048 pounds) net, and about 2,900 kilogrammes (6,393 pounds) gross, when in running order, and carrying three men and fourteen liters (105.68 gallons) of water. It is capable of running 60 kilometers (37¼ miles) at a rate of 19 kilometers (11.79 miles) an hour without being recharged. At this speed the current consumption is 50 amperes. Upon a good road it will run 22 kilometers (13.66 miles) an hour with a current consumption of 60 amperes. The pump is of the three-cylinder type, and it forces the water with a pressure proportionate to the current used by the motor. The delivery at 20 amperes corresponds to about 60 pounds to the square inch, while with 35 amperes a pressure of about 120 pounds can be had. The pump delivers 80 liters (21.13 gallons) of water per minute through a nozzle 7 millimeters (.275 inch) in diameter at a pressure of 60



STEAM AUTOMOBILE FIRE ENGINE OF THE PARIS FIRE DEPARTMENT*

* Courtesy of *Scientific American.*



AUTOMOBILE COMBINATION CHEMICAL USED IN PARIS *

pounds per square inch, and 200 liters (52.84 gallons) per minute through a 10-millimeter (.393 inch) nozzle at a pressure of 105 pounds per square inch. The pump drives the water through the axis of the reel into the rubber hose, which is wire-wound and has an interior diameter of 35 millimeters (1.377 inch). It is also capable of raising the water, at the suction end, 7 meters (22.96 feet). The gearing of the motor is so arranged that it can run the vehicle or the pump without either conflicting with the other. It is a 4-kilowatt motor, operated by a storage battery weighing 580 kilogrammes (1,278 pounds), and having a capacity of 180 ampere-hours.

Three screw-threaded openings issue from the water compression chamber, one having a diameter of 7 millimeters (.275 inch), one of 10 millimeters (.393 inch), and one of 12 millimeters (.472 inch). The smallest one is coupled on when the pump is working from its sole supply of water carried in the tank, which enables it to run five or six minutes at the pressure above stated. The second, or 10-millimeter opening, is used whenever there is an opportunity to draw the water from some other source, and the accumulators have sufficient capacity to run the pump under these conditions for six hours. The third, or 12-millimeter opening, is used when there is a good pressure at the hydrants. Under such favorable conditions the hose is attached to this, the engine suction hose is withdrawn, and the pump is not used. Where such favorable conditions exist, the rôle of the pump is simply to provide an instantaneous means of fighting the fire while the connections to the hydrants are being made, i. e., during a lapse of five or six minutes at most.

Arrangements have been installed, by means of which a portion of the energy of the accumulators may be used for illumination on dark nights, either through arc or incandescent lights. The latter are preferable in cases where it is feared explosives are in the neighborhood of the fire.

Three men compose the crew of an automobile fire engine of this type, and even two will be able to run it. One man runs it through the streets, attends also to the pumps and, upon occasion, can couple it to the hydrant. A second man, the fireman proper, unrolls and lays the hose and directs its stream upon the fire. If there is a third man he assists the second in his duties, attaches the suction hose, and thereby increases the rapidity of the work and saves time. The crew of the engine are always dressed and on the *qui vive* for the alarm, so that their departure is effected without delay.

For five years now the city of Vienna, Austria, has not had a steam fire engine in service. In the place of steam pumps chemical engines are used. In other words, the fire-fighting apparatus consists of cylinders of sheet steel, mounted upon wheels, and containing 600 liters of water, which is thrown upon the fire by means of compressed carbonic-acid gas.

The compressed carbonic acid is carried upon the truck in steel cylinders. The photograph which we append, and for which we are indebted to the obliging chief of the fire department of Vienna, will give a clear and precise idea of the form and construction of the vehicle. It is in fact an electric automobile, capable of a speed of 24 kilometers per hour, which is more than is permissible in the cities. In the cut also can be seen all the accessories with which the engine is furnished, as well as their various positions. As the picture shows, the carbonic-acid cylinders and the water reservoir are placed at the rear of the vehicle.

* Courtesy of *Scientific American*.

Fire and Police Personals

—W. A. Chisholm has been elected chief of the Sanford, N. C., fire department.

—Former Fire Chief John G. Pendergast, of Indianapolis, Ind., died at the age of seventy years.

—Henry J. Montgomery has succeeded W. W. Byras as chief of the North Adams, Mass., fire department.

—Fire Commissioner Richard F. Connolly has been elected president of the Jersey City, N. J., fire board.

—After having been fire chief for thirty years, John W. Hoover, of Cabery, Ill., has resigned, and his successor is Carl Ross.

—Reuben Warner, Jr., has been re-elected, for the fifth time, president of the board of fire commissioners of St. Paul, Minn.

—Mayor Lucey, of Streator, Ill., has removed John James as chief of the local fire department, and appointed Frank Owens in his place.

—William Robinson, known as "The Model Fireman" of the Philadelphia fire department, is dead. While responding to a fire alarm he was run over by a locomotive and had his left leg and arm cut off. He suffered agonies for four days and was then released from his suffering.

—Chief Samuel S. Elferth, of the Trenton, N. J., fire department, holds the distinction of having been appointed chief three times. In 1891 he was appointed chief for the third time, and has held the position ever since. His tenure of office now seems to be unlimited during good behavior.

—Captain Edward Ryan, of the New York fire department, was maimed for life by having both bones in the right leg broken, below the knee. The driver of the engine turned the team into an "L" pillar to escape colliding with a truck that was in the way, and Captain Ryan was thrown off.

—The following fire chiefs have been elected or re-elected: George Phister, Easton, Pa.; Herbert E. King, Mansfield, Mass.; George W. Dorman, Athens, Ga.; John Shupp, Jr., Harrisburg, Pa.; Joseph Bellis, Annapolis, Md.; H. O. Krueger, Cudahy, Wis.; John Gregg, Marquette, Miss.; R. S. Hilyear, Wilton, Wis.; William Kehner, Ebenezer, N. Y.; John Byrne, Westbrook, Me.; C. J. Kloster, South Sioux City, Ia.; Hugh Waddell, Baton Rouge, La.; George Lorig, East Milwaukee, Wis.; James McWilliams, North Braddock, Pa.; S. C. Reed, Newburyport, Mass.

New Police Headquarters for New York

THE new Police Headquarters building in New York, for which bids will be opened on Jan. 26, will be one of the handsomest buildings of its class in the country, and will incorporate many unique features. It will occupy the entire square bounded by Center, Grand and Broome streets and Market place. The architecture will be of the Georgian period of the British Renaissance, and will resemble the old City Hall. It will be six stories high, surmounted by a dome, and is to be built of limestone and granite. People seeking a private interview with the Commissioner may enter under a *porte cochere* at one end, and be ushered up by private elevator without using the public corridors. The lost children department will be connected with a play garden on the roof, and the dome will be equipped with both wire and wireless telegraph stations. In the basement there will be seventy-five cells, each of which will have light and air, and there will be special corridors for prisoners when being taken before the sergeant or inspector. Sleeping rooms, bath-rooms and lavatories are provided on every floor, and a large drill-room has been arranged for in the plans. The cost of the building is not to exceed $750,000.

Chief Kellogg on Fire Fighting

IN an interview since the recent disastrous fire in Sious City, Ia., George M. Kellogg, the Chief of the Fire Department of that city, said: "Fire fighting has been reduced to a science, though I can hardly explain what I mean by that. No two fires are alike, and one cannot sit here and may out a campaign for the next blaze. Every fire has a characteristic of its own, and, perhaps the only general rule when one is discovered is to put water on it.

"Practically every fireman understands that the proper place to fight a fire is from the bottom, and that, when beset with smoke, the purer air is close to the bottom.

"Generally speaking, the hardest kind of a fire to fight is one that starts in a basement. It is harder to get at than anywhere else, and no matter how small it may be it fills the upper floors with smoke, making suffocation likely. Then there are stairways and elevator shafts which create a draft, carrying the fire upward and spreading it rapidly. The fire in the Massachusetts Block began in the basement, and it was but a moment before it had spread to the inflammable stuff all through the building. By the time that the company arrived flames were shooting from the windows on all sides, and all that could be done was to surround it and try to confine it to the building.

"This is done by keeping water pouring into the place from all sides, but the wind soon carried it across the street, and the only thing to do then was to try to prevent it from spreading. The method is to keep a sheet of water pouring down the side of the threatened building. This was done to some extent, but the pressure was so weak that the water barely reached the second story.

"There is little choice as regards hazards in the fire service. The hook and ladder men must accompany the hose men and assist in getting at a blaze, and no fireman can tell when he will be cut off, for fire is treacherous, and, too, he must take chances on explosions from gas, or other materials."

Chief Kellogg says, regarding methods for saving life, that: "The life net, or aerial ladder is useful if not interfered with by wires. The pompier ladder is used effectively by some departments. A fireman attaches a ladder with hooks to the window of the second story and scales the wall, carrying a second section of the ladded with him. When that is attached to the third story window, the first ladder is carried, and so on to the desired height. In carrying a person out of a burning building, the fireman usually keeps the person in front. If he is conscious he will assist the fireman in clinging to the ladder. If unconscious, the fireman has to keep the body between him and the ladder and roll it down as he descends."

LITERATURE ON MUNICIPAL TOPICS*

Reviews of Some Important Books—What the Magazines and Reviews Have to Say about Civic Affairs—Municipal Reports Received

Books

Life and Labor of the People in London. By Charles Booth. Second Series: Industry, 5 vols. 20s. the set. The first series, of four volumes, was entitled "Poverty," and a third series, of four volumes, on "Religious Influences," and a final volume of "Summary and Conclusion" are to follow. The entire work is a study of metropolitan social problems based on the figures of the national census. The first volume of this second series—the subsequent volumes are reserved for future notice—treats of the Building Trades, the Wood Workers, and the Metal Workers. In the general classification of the entire population these are classed as "in poverty," and including the poor and the very poor, 31.5 per cent., and those in comfort 68.5 per cent. Of 250,000, that is, 6 per cent., of the whole, rated as upper classes, 50,000 have but one servant; 50,000 with but two servants to wait upon from six to ten, or more, persons; 50,000 in smaller families with two servants, and 100,000 who have three or more servants, less than 30,000 of whom enjoy the luxury of a household with a greater number of servants than those whom they serve.

Industries are divided into 89 classes which are included in 17 branches. The building trades includes every trade connected with the construction or completion of a building. The part of work dealt with by each class is treated statistically and scientifically and the differentiations are clearly stated, showing when the bricklayer, for instance, must leave off for the tiler to begin, the Unions being exceedingly sensitive about overlapping. Apprenticeship has almost died out in London, and most artisans have either picked up their knowledge of their trade or have come from the country. Wages vary largely between the rush and slack seasons, 9½d. per hour being about the average for a skilled workman, and nine-hour days being the rule. Much attention is given to the Trades Unions in the different chapters. The book is an immense reservoir of figures, adapted by means of charts for ready reference. The deductions of the author must be treated in another notice.

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Grouping of Public Buildings; Bulletin No. 2; The Municipal Art Society of Hartford, Conn. This is a compilation by Frederick L. Ford, one of the vice-presidents of the society and City Engineer of Hartford, of a series of articles which have appeared from time to time in the Connecticut newspapers. Civic centers in European cities are described and discussed in several of the articles, and in others the present condition, together with the proposed improvements and possible arrangement of public buildings in some of our American cities, is set forth. Every article is either in the description of the beauty of old-world cities or in the suggestions for improvements at home, an argument for the grouping of civic buildings in an harmonious and impressive arrangement and surrounded with parks and monuments. The method so frequently used in American cities of selecting the site for a public building to favor some alderman's constituents, and without regard to surroundings, is of the past, and the people are now demanding that civic structures shall occupy sites fitting to their character and with artistic and dignified surroundings.

♣

An Outline of Municipal Government in the city of New York, by George Arthur Ingalls, B. A. Cloth, 8vo., 79 pages, with index. Price, 75 cents.

The author of this book has found an unoccupied field and one that urgently needed attention. To secure an accurate idea of the government of the greatest American city required not only a study of its charter but a search through many volumes of Session Laws for the modifications of that organic law that have been made from time to time by the State Legislature. The purpose of the author has been to draw in outline a full length portrait of municipal government in the city of New York, and he has succeeded in producing a compendium that is both accurate in its detail and convenient of ready reference. The book possesses genuine value for all who are in any way connected with or interested in municipal affairs.

♣

Crushed Stone and Its Uses, W. J. Jackman, is a handsome manual of "facts of importance in connection with modern concrete construction," published by the Producers' Supply Company, of Chicago, for complimentary distribution. It consists of testimony by experts in engineering, architecture and building, to the effect that concrete, made with crushed limestone, screenings and good cement is the ideal material for every form of construction in which economy and permanence are required.

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Articles in American Periodicals

German Municipal Social Service, by Howard Woodhead, is published in *The Chautauquan,* Chautauqua, N. Y., for February, 1905. It is the sixth article on *Civic Lessons from Europe,* which have been published monthly, and it will be followed by three more.

♣

The Engineering News, New York, February 2, contains *The Sewerage and Drainage Systems of Wheaton, Ill.,* by William B. Ewing; also an illustrated article on *Septic Tanks and Intermittent Sand Filters at Saratoga Springs, N. Y.*

♣

The Water Filtration Works at Anderson, Ind., by F. B. Leopold, is an illustrated article on the filtration plant just completed at Anderson. This article, together with *The Revised Plans for the Purification of the Pittsburg Water*

* Any book or periodical reviewed or mentioned in THE MUNICIPAL JOURNAL, or elsewhere, will be sent to any address on receipt of price.

Supply, with diagrams, is published in *The Engineering Record,* New York, February 4.

The Use of Incandescent Lamps for Decorative and Advertising Purposes, in *Electrical Review,* New York, February 11, gives some ideas of the extent to which special illumination is carried in New York City.

The Dry Mixture of Cement, by Mr. A. L. Goetzman, Chicago, read at the Indianapolis meeting of the National Association of Cement Users, appears in *The American Gas Light Journal,* New York, February 13.

The Engineering Record, New York, January 14, 1905, contains an article on *The Water Filtration Works at Philadelphia.*

The Functions of Various Types of Bacteria in the Purification of Sewerage, with Some Methods for Their Quantitative Determination, by H. W. Clark and Stephen De M. Gage, and *The Copper Sulphate Treatment for Algae at Middletown, N. Y.,* by James M. Caird, Assoc. Am. Soc. C. E., are two articles that will interest city officials, and are published in the *Engineering News,* New York, January 12.

Concrete, Detroit, Mich., for January, has as a leading article, *Materials Which Retard the Setting of Portland Cement,* by R. C. Carpenter.

Removal of Snow from City Streets, by Leicester Allen, deals with the costs and methods of removing snow from the streets of cities of the size of New York, and how it may be done quicker and more economically. *Sewerage Disposal at Saratoga Springs,* contains a number of illustrations and diagrams of that plant. Both articles are in *The Engineering Record,* New York, January 21.

Waterproofing Concrete Structures, by W. H. Finley, M. Am. Soc. C. E., is an abstract of a paper read at the meeting of the Cement Users' Association, held at Indianapolis, January 17-19. It is published in *Engineering News,* January 26

The American Journal of Sociology, Chicago, Ill., January, 1905, contains as a leading article, *Problems of Municipal Administration,* by Jane Adams, of Hull House, Chicago. It is an address delivered by Miss Adams at the International Congress of Arts and Science, Department of Politics, in September, 1904.

Articles in Foreign Periodicals

The Surveyor, and Municipal and County Engineer, London, January 13, contains *The Combination of Dust Destructors and Electricity Works, Economically Considered,* by W. P. Adams. This article will be of especial interest to officials of cities contemplating the installation of garbage destructors. There are five comparative tables in this article. Price, 3 pence.

Water, London, January 16, contains an illustrated article on *Circulating Reservoir at Sundridge Park,* by Walter Bell, and two articles, with diagrams, on *Electrically Driven Pumping Plant,* by J. Hutton, and *Water Hammer in Pipes,* by O. Simin. Price, 6 pence.

Electric Tramways in Hong-Kong, is the title of an illustrated article on the electric street railway that was completed on the island last July. It is published in *The Electrical Review,* London, January 13. Price, 4 pence.

The Surveyor, and Municipal and County Engineer, London, January 27, contains an illustrated article on *Municipal Warsaw,* by Francis Leon Trembick, and also *Asphalte Roads, Technical, Hygienic and Economic Considerations,* by Albert Wollheim. Price, 1 shilling.

Standards of Purity of Sewage Effluents, by Dr. Dunbar, of Hamburg, is a paper read at the Twenty-second Congress of the Royal Sanitary Institute, held at Glasgow in 1904. It is published in *The Sanitary Record and Journal of Sanitary and Municipal Engineering,* London, January 26.

The Public Health Engineer, London, January 28, contains an illustrated article on *Refuse Destructor Installations,* in Glasgow. Price, 3 pence.

Public Works, London, January, contains *New Abattoirs at South Shields,* by F. Burgess; *Some Public Works in the United States; The Public Works of Dresden,* by Dr. Karl Seuterman; *New Sewage Disposal Works in Middlesex,* by Reginald Brown; *Some Public Works in Austria; London Water Supply,* by P. Cotlancin. Price, 2s. 6d.

The Electrification of the Metropolitan Railway is an illustrated article started in *The Electrical Review,* London, January 20, and finished in the issue for January 27. Price, 4 pence.

The Extraction of Grease from Sewage, by Joseph Garfield, Esq., A. M. S. C. E., Sewage Works Engineer, Bradford, England, a paper read before the meeting of the Association of Managers of Sewage Disposal Works, appears in *The Sanitary Record and Journal of Sanitary and Municipal Engineering,* London, February 2; also a paper on *Refuse,* read before the Sanitary Association of Scotlond, by Mr. James Murray, C. E., County Sanitary Inspector, Renfrewshire. Price, 3 pence.

The Combination of Dust Destructors and Electricity Works, Economically Considered, is an article concluding in *The Public Health Engineer,* 50-52 Ludgate Hill, London, E. C., February 11. This article appears in the issue of December 24. Price, 3 pence.

Disease Fighting, an article on the opening of a new and important laboratory of public health for the study of diseases by the city of Manchester, England, appears in *The Municipal Journal,* London, February 10; also *The Origin of Municipalities,* a lecture delivered at the Liverpool University, by Mr. Edward R. Pickmere, M. A., Town Clerk of Liverpool. Price, 1 pence.

METROPOLITAN WINS COMPETITIVE TESTS

THERE have been many statements pro and con about the competitive fire engine tests recently held at Napa and Los Angeles, Cal. Naturally, THE MUNICIPAL JOURNAL has refrained from referring to the matter because of the incompleteness of the information at its command. The atmosphere, however, is cleared in the statements contained in the following letter recently received from Mr. C. J. Cross, sales manager of the American-La France Fire Engine Company, Elmira, N. Y. In addressing THE MUNICIPAL JOURNAL he says:

"The following statement is made to place the true conditions before the public.

"The official report given by the judges at Napa, who were hostile to our engine, presumably on account of the alleged 'trust' talk, is as follows:

Test Number One

Nott best, showing ten points.

Test Number Two

LA FRANCE (METROPOLITAN)	NOTT
Steam pressure.....134 3/10	Steam pressure.....135
Water pressure engine.....200	Water pressure engine.....174 4/5
Water pressure nozzle..... 46 1/10	Water pressure nozzle..... 63 1/10

Highest steam pressure: Nott, 10 points.
Highest water pressure: La France, 20 points.

Test Number Three

LA FRANCE (METROPOLITAN)	NOTT
Steam pressure 132 3/5	Steam pressure 131 2/5
Water pressure, right.....162	Water pressure, right.....141
Water pressure, left.....172 2/5	Water pressure, left.....163 1/5
Water pressure, nozzle..... 80	Water pressure, nozzle..... 67 4/5
Water pressure, nozzle.....112 4/5	Water pressure, nozzle..... 94 1/5

Highest steam pressure: La France, 10 points.
Highest water pressure: La France, 20 points.

Test Number Four

LA FRANCE (METROPOLITAN)	NOTT
Steam pressure 132	Steam pressure 134 3/5
Water pressure at nozzle No. 1 ..... 53 1/10	Water pressure at nozzle No. 1 ..... 55 1/5
Water pressure at nozzle No. 2 ..... 93 3/10	Water pressure at nozzle No. 2 ..... 93 7/10

Test Number Five

LA FRANCE (METROPOLITAN)	NOTT
Steam pressure 132 1/3	Steam pressure 133 4/5
Water pressure, right.....197 5/6	Water pressure, right.....160
Water pressure, left.....195 4/5	Water pressure, left.....167 6/7
Water pressure, nozzle..... 83 2/3	Water pressure, nozzle..... 61

Highest steam pressure: Nott, 10 points.
Highest water pressure: La France, 20 points.

Test Number Six

LA FRANCE (METROPOLITAN)	NOTT
Steam pressure 132 2/3	Steam pressure 135
Water pressure, right.....182 1/6	Water pressure, right.....170 1/6
Water pressure, left.....179	Water pressure, left.....162 1/3
Water pressure, nozzle..... 61 1/3	Water pressure, nozzle..... 45

Highest steam pressure: Nott 10 points.
Highest water pressure: La France, 20 points.

Test Number Seven

LA FRANCE (METROPOLITAN)	NOTT
Steam pressure.....138 1/3	Steam pressure 140 1/3
Water pressure, right.....280	Water pressure, right.....241 6/10
Water pressure, nozzle..... 63 2/3	Water pressure, nozzle 53 1/3

Highest steam pressure: Nott 10 points.
Highest water pressure: La France, 20 points.

Test Number Nine

Nott engine makes best showing on cold water pressure 10 points.

"All these various tests were signed by five judges, and it is also to be noted that the 'La France' referred to above should be 'Metropolitan' as it was a 'Metropolitan' engine used.

"The Metropolitan engine won the competitive test at Napa, completely outclassing the Nott engine, and while the Metropolitan engine was taken back to its store room in perfect condition, the Nott engine was badly burned around the top of the boiler. Another point I should like to call attention to and that is, there were committees from both Oakland, Cal., and San Francisco, Cal., at Napa to witness the test. An order for three Fox boilers was in the balance at Oakland until they could see the demonstration at Napa. Three days after the Napa test, we secured an order, for these three boilers at Oakland, on the showing made at Napa.

"On January 21st engines were tested at Los Angeles, Cal., but before giving the results of that contest I wish to call attention to several statements contained in a letter addressed to each member of the City Council and the Fire Commission:

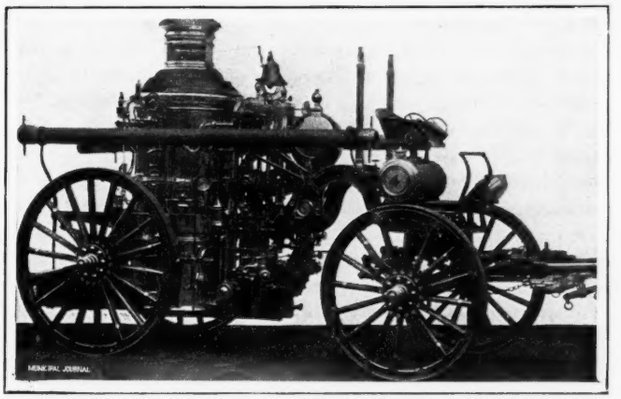
"'The first test, which is the most practical fire fighting test which could be devised by your Commission—that of placing a stream of water a distance of 100 feet in the shortest time—demonstrating the practical workings of the engine at a fire, was easily won by us. We placed water over the line and thirty feet beyond, beating our competitor over one minute and a half, which is a long time at the critical moment when an engine should be getting ready to place water on a fire. At the conclusion of this test I asked your judges if they conceded the test to us, and their answer by Mr. Rademacher was: "Yes, there was no doubt about it."

"'The second test was also easily won by us, but during this test the first breakdown on the Nott engine occurred. Due to the excessive vibration, the front spring lock broke, which, however, did not interfere with the running of the engine, and they finished the test, although, as said above, we beat them handsomely.

"'During the third test, which was safely won by us according to our records, it was noticed that the Nott engine was in distress. The engineer had a stream of cold water playing on some of the bearings to keep them cool, showing either bad alignment or improper construction in some other way. The reason, however, soon developed as the main shaft broke completely, allowing the balance wheel to fly to the ground, falling in the lake, which, of course, disabled them, putting their engine out of commission and caused a shutdown. It was also noticed at that time that their boiler was leaking badly, which would have been reason enough for their stopping. The Nott Company requested a postponement of the balance of the test until Jan. 24th, saying that they had another engine here which they could bring out and finish the test.

"'The judges referred the matter to me, asking if I would submit to a postponement, which I readily granted, not only confirming my statement that I came here for a fair fight, but I also took the stand that I wanted to outclass their engine with them at their best rather than crippled. They, therefore, had the disabled engine returned to the corporation yard and set about to get the other engine in shape. It, of course, was not the fairest thing in the world that two engines should be brought out against our one engine, but we were so confident of the ability of our engine to demonstrate its great strength and staying qualities over that of the Nott Company, that I would not hesitate in placing our engine against two or even more of their engines. I feel that we have allowed them what they would not have allowed us under similar circumstances, but it is the respect of the judges that we are aiming for and we are willing to disregard what might have been the case had our engine broken instead of theirs. In taking the first Nott engine back to the repair shops it was noticeable that it was badly injured around the top of the boiler even on this very short run. The top of the boiler was badly burned, and the enamel burned off. This, you understand, was the result of less than an hour's solid running. After this engine was returned, either Saturday evening or Sunday morning, they re-enamelled the top of the boiler to conceal this defect and the re-enameling is clearly evident even now.

"'On January 24th we began the balance of the test, we, of course, with the same engine, they with the second new one. Almost from the first it was noticed that contined mishaps occurred on their engine. Before a half hour's running the extreme burning of the boiler at the top was again noticeable on this engine as on the other. The enameling began to peel off and the dome became discolored. The safety valve gave out, causing a shut-down until a new one could be procured. This safety valve gave out because of the excessive heat, unmechanically allowed to be created at this particular point, due to the construction of their boiler. They started again, running possibly ten to fifteen minutes, when the new safety valve gave out for the same reason. The temper was taken out of the spring in the safety valve, due to the excessive heat. They again shut down, sent up town for another and attached the third safety



ONE OF THE LA FRANCE ENGINES

valve. These accidents, of course, made it necessary to stop entirely, draw out the fire, cool off the boiler, and otherwise putting the engine entirely out of commission, which would not be very good practice at a fire. Steam escaped through the broken oil cup attachment in the cylinder. In fact, at no time was their engine to be depended upon for continued fire service.

"'At the end of the day's test the boiler on the Nott engine was so badly burned and the dome so badly discolored that it was freely commented on by the crowd, and the judges themselves gave orders that no cleaning up should be done until they made their official examination of the boilers. In view of the fact that our Metropolitan engine is in perfect condition, showing no signs whatever of the work on which the two Nott engines show much weakness, we feel it is due us that your Fire Commission should consider the ability of the two engines in maintaining contnued fire servce for a period of years. The fact that our engine is on its way to Fresno, where it has been sold, clearly demonstrates our confidence in the fact that the engine would be and is in perfect condition. The test which we have given it in competition with the Nott engine is no harder than we give all engines at the factory before shipping them.

"'The above is a general statement of facts and, of course, is written before the official verdict and reports are rendered by the three judges above mentioned, but as they have been so fair and square during these tests, I do not doubt but that they will render us a greater number of points, which we undoubtedly deserve; but my greatest claim is on the superiority of our engine for continued fire service year in and year out. If this point alone is seriously considered, I would willingly waive the points that we gained on them, for I feel that it would gain for our engine the respect and prestige which we believe due us, and which we are very anxious to create in the minds of your officials.

The committee which was to decide the above contests at Los Angeles submitted the report of which the following is a summary:

	American-La	*France*	*Nott*
Steam	50		30
Water	60		60
Height of stream, average	20		40
Total	130		130

"The above report of the judges to the Mayor was made in private, while the tabulated statement of pressures shows a tie, which is a mechanical impossibility, and under these conditions there is a direct admission that we won the test by a great margin, for had it actually been a tie the report coming through the Mayor's hands in private would have very strongly favored the Nott Company.

"Our Metropolitan engine was then delivered to the city of Fresno. Rumors have reached us that reports have been circulated that Fresno had refused to accept our engine after going through the test. That we denounce as false, pure and simple, for the city of Fresno has unqualifiedly accepted the Metropolitan engine according to a telegram since received. (Signed) C. J. Cross, Sales Manager, American-La France Fire Engine Co."

The Acme Road Machinery Company

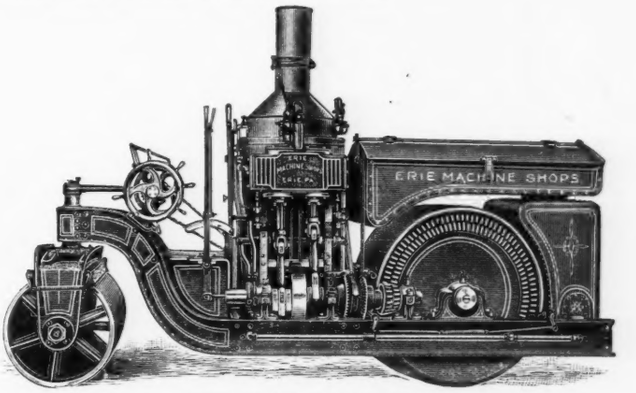
At its annual meeting, the Acme Road Machinery Co., of Frankfort, N. Y., January 20, 1905, re-elected the following directors: W. A. and D. B. Cook, Jas. Dempsey, Jas. W. Jones, of Frankfort, N. Y.; T. G. Ingersoll, Vernon, N. Y.; P. Pollock, Troy, N. Y.; A. Schaupp, Albany, N. Y. At a subsequent meeting of the directors, the following officers were elected for the ensuing year: President, Philander Pollock; vice-president, Alonzo Schaupp; secretary and treasurer, Jas. W. Jones; general manager, W. A. Cook; counsel, Jothan P. Allds. The business of the company for the past year has been one of the largest in its history, and the outlook for the ensuing year is promising. A large number of orders have already been booked for spring delivery, and the works are running on full time.

Mr. C. E. Hoag, of New York, who has been with the American Road Machine Co. and the Good Roads Machinery Co., of Kennett Square, Pa., for the past sixteen years, has severed his connection with these companies and associated himself with the Acme Road Machinery Co., and will have charge of its sales department in Hudson Valley and New York City. Mr. Chester A. Hoag, who was formerly associated with the Good Roads Machinery Co., has also joined the traveling force of this company.

From Road Plows to Steam Rollers

It is more than a mere convenience to be able to make all one's purchases "under one roof," as the department stores say, and this is equally a fact with road machinery as with dry goods.

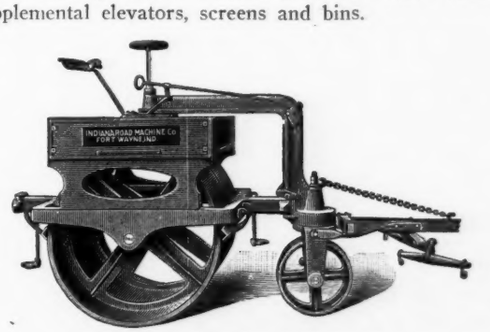
The Commercial Railway Equipment Co., of 42 Broadway, New York City, have grasped this idea, and become the representatives of a number of the standard machine companies practically uniting the products of several factories.



ERIE STEAM ROAD ROLLER

Everything necessary to the street department may be had through them from road plows to steam rollers, fully guaranteed, and with the knowledge that the makes have been carefully selected by experts to secure those most satisfactory.

Among their specialities are the Indiana Road Making Machinery, which has become standard. The improved reversible road-grader made by this concern combines all the latest practical ideas with honest workmanship, which is also true of their stone crushers, with their supplemental elevators, screens and bins.



INDIANA REVERSIBLE ROAD ROLLER

The new reversible road roller shown in the cut is built in 4, 5 and 6-ton sizes, each 54 inches wide, and varying from 56 to 60 inches in diameter. It is reversible without the driver leaving his seat, and saves time and power otherwise required in turning.

The type of steam roller illustrated in the cut is especially adapted for use on asphalt and brick pavements, low crowned macadam roads, racetracks, parks, driveways, etc. Its characteristics are strength, durability, ease of manipulation and the positive motion in all of its actuating parts. They are built in sizes from 2½ to 8 tons.

Asphalt mixers, feed water heaters, hoisting machinery for quarries, pile driving, bridge building and general contractors' work, besides a long list of other machinery, are included in the catalogue of this company.

The business is under the personal management of Mr. Geo. H. Howes, a practical engineer with a large and varied experience in contracting Government work.

Pittsburg Meter Company's Salesmen's Convention

THE accompanying photograph is a group of the officers and traveling representatives of the Pittsburg Meter Company, of East Pittsburg, Pa., and was taken upon the occasion of their recent annual convention. It has been the custom of this company to have its traveling representatives meet once a year at headquarters for the purpose of discussing business in its various aspects. The conference this year lasted for several days, at the end of which the visiting salesmen were tendered a banquet at the Duquesne Club by the company's manager, Mr. A. G. Holmes. The banquet was one of the most delightful gatherings of this kind the company has ever held. The following officers of the company were present: A. G. Holmes, manager; T. C. Clifford, general agent; R. M. Stotler, advertising manager. Representatives: J. H. Foley, Guthrie, Oklahoma; A. D. Hays, Minneapolis, Minn.; J. H. Davis, Kokomo, Ind.; A. J. Pray, Columbus, Ohio; V. E. Arnold, Scranton, Pa.; W. A. Holmes, W. T. Mechling and H. I. Miller, Pittsburg, Pa.

SALESMEN OF THE PITTSBURG METER COMPANY

The Pittsburg Meter Company is an old Pittsburg concern and one of the earliest Westinghouse enterprises. At the time natural gas was first made commercially useful in the city the company was known as the Fuel Gas & Manufacturing Co., and most of the appliances for the economical use of gas in private houses, mills and factories were introduced by the company. The Fuel Gas & Manufacturing Company moved to East Pittsburg, Pa., in the early '90's, and the name was subsequently changed to the Pittsburg Meter Company, as the company became more closely identified with the manufacture of meters.

Owing to the increasing difficulty of procuring pure and adequate water supplies, due to the rapid increase in population and the resulting contamination of the water sources, and also to the unrestricted waste of water supplied by water works to consumers on the flat rate basis, there was an urgent demand for a satisfactory water meter to accurately measure the water consumed by each water taker. To meet this demand the company designed and commenced the manufacture of the Keystone Water Meter, which is now so extensively used throughout the country; in addition to which the company makes gas meters of all descriptions for the measurement of either natural or artificial gas.

Although the company's increase in business during the past year was almost phenomenal, it has enough contracts and orders booked at the present time to assure it as great a ratio of increase in its business for the coming year.

The East Boston Tunnel

ON the 31st of December last, the first train carrying passengers passed through the East Boston tunnel, thus marking the completion of a great project. The tunnel is a part of the Boston system of subways, and passes under the harbor, uniting by a rapid transit line Boston and East Boston.

The Act authorizing the building of the tunnel was signed June 10, 1897. The first contract was made in April of 1900, and active construction was begun very soon after. The completion of the tube has therefore required almost five years.

The total length of the tunnel is approximately 7,500 feet, of which fully two-thirds was built by the shield method, the remainder in open cut excavation. The portion of the bore actually under the water of the harbor is about 2,700 feet long, the balance of the tunneled portion passing through "made ground" filled in as the growth of the city demanded. A depth greater than at present essential was demanded by the fact that allowance had to be made for possible dredging of the harbor to make a 40-foot channel. To meet this condition different grades were required in the tube.

For the first 2,100 feet the tunnel descends by a 5 per cent. grade; for the next 2,100 feet, reaching almost across the harbor, an ascending grade of 0.5 per cent. is maintained; then follows a length of 1,000 feet at 2.5 per cent.; 1,800 at 4, 2.5 and 1.5 per cent., and the final rise on a 3 per cent. grade for perhaps 500 feet. The greatest depth attained by the tunnel invert is about 80 feet below mean low water. The least thickness of earth between tunnel and water is 18 feet. The cross-section of the completed structure varies at different points, but in general is the well-known horseshow type. The bore is lined throughout with concrete, reinforced where necessary by steel rods bedded in. Ventilation is provided by powerful fan plants forcing fresh air from either end and electric lights illuminate the interior.

In construction the line was divided into six sections, lettered from A to F. Sections B and C aggregate 5,150 feet in length, and so form the major part of the contract. They are most interesting as having been constructed wholly by sub-surface tunneling methods. Section B, 4,400 feet long, was started at a shaft in Lewis street and was driven by the pneumatic shield method, almost the entire distance being made under air pressure. The air locks were three in number; the one near the top of the tunnel section being used almost exclusively by the men, the two lower ones giving exit to the excavated material. The side walls of the tunnel were built in advance of the shield in lateral headings. The roof shield, a heavy structure of steel work, was forced forward by powerful hydraulic jacks, being supported on rollers resting on plates on the walls. The air pressure required averaged about 22 pounds; the maximum was sometimes as high as 27 pounds. The volume of free air delivered to the headings averaged about 20 cubic feet per minute for each workman, and it was forced into both side drifts and above the shield, as well as in front of it. The compressing plant for this section included three Ingersoll-Sergeant air compressors; two low-pressure straight-line single-stage Class "A" machines furnishing air for the working chamber in the shield; and one high-pressure straight-line two-stage Class "AC" machine delivering air at a pressure of about 115 pounds. This high-pressure air was used in pumps operating the hydraulic jacks for moving the shield, developing a pressure of 4,000 pounds per square inch, applied in the sixteen jacks of 75 tons capacity each. This air was also used in driving motors running concrete mixers, winding engines, and other devices; while a portion was discharged direct into the advance headings for ventilation. The combined free air capacity of these three compressors was something over 2,500 cubic feet per minute, and they were driven by steam from a battery of three 100 h. p. boilers.

Section C, 750 feet in length, included that portion of the line between Atlantic avenue and India street. The method of tunneling was in general that used in Section B, starting from a construction shaft near the Custom House. The shield used here was very similar to that in the other tunnel section and it was manipulated in the same manner. Three air locks gave access to the working chambers. The air pressure in front of the shield averaged about 18 pounds. The compressed air for this section was supplied by four Ingersoll-Sergeant steam-driven air compressors. Of these, two were straight-line high-pressure Class "AC" machines, having a combined capacity of about 1,500 cubic feet of free air per minute, delivered at 120 pounds pressure; the other two were low-pressure machines of straight-line Class "A" type, with an aggregate free air capacity of 2,300 cubic feet per minute, compressed to 40 pounds. The low-pressure air gave ventilation and pressure in front of the shield; the high-pressure air served as a motive for pumps, winding engines and other appliances.

The total cost of the tunnel complete has exceeded three million dollars. The work was completed in the contemplated time and the methods of construction were found in every way satisfactory. The opening of this tunnel to traffic has reduced the time of transportation between Boston and East Boston by more than ten minutes and the improved facilities are far-reaching in their influences.

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The Fabric Fire Hose Co., of New York, in its "Fire Engineers' Handbook," recently published, gives some interesting information about rubber hose.

Items of Interest about the Trade

—W. H. Anderson & Sons, 21 St. Aubin avenue, Detroit, Mich., have recently put on the market a new automobile jack, of which the company will be glad to send a descriptive circular on application.

—The United States Government has adopted and installed "Universal" pipe made by the Central Foundry Co., of 116 Nassau street, New York, on Ellis Island, New York Harbor, and has specified the same for use in other places.

—Mr. A. J. Aubrey, a graduate of the School of Mines, Ohio State University, Columbus, O., has recently been put in charge of a complete laboratory in connection with the Laclede Firebrick Company, St. Louis. This concern manufactures firebrick, tiles, sewer, culvert pipe, etc.

—The Cleveland Vapor Light Co., 1 Broadway, New York, with home office at Cleveland, O., on January 31, 1905, was awarded the contract for 300 lamps, gas and gasolene, at Newport, R. I., for three years. This concern won out in competition with the Welsbach and American Lighting Co., of Baltimore.

—It will be of interest to fire chiefs and commissioners throughout the country to know that Mayor Thos. A. Combs, of Lexington, Ky., in asking for bids on combination chemical engine and hose wagon recently, specified that the wheels be equipped with the Firestone rubber tires, made by the Firestone Tire & Rubber Co., of Akron, O.

Mr. Warwick H. Payne, who has for a number of years been connected with the Eureka Fire Hose Co., New York City, as manager of its Southern department, with headquarters at Atlanta, Ga., has been placed in exclusive charge of the States of North and South Carolina and Virginia, with main office at Atlanta, No. 704 Century Bldg., where he will be assisted by Messrs. Chas. B. Payne and H. H. Alvis.

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Publications Received

—The C. O. Bartlett & Snow Co., Cleveland, O., has recently published an extensive catalogue of 338 pages, with cover, which will be of interest to those who have anything to do with elevating, conveying, mining and milling machinery. It is known as catalogue No. 15, and will be sent upon request to any address.

—The H. W. Johns-Manville Co., of 100 William street, New York, has recently issued a small 12-page catalogue, illustrated, printed in two colors with cover, descriptive of certain brands of goods manufactured in asbestos. This Company also deals in pipe and boiler coverings of all classes and will send a descriptive catalogue upon request.

—W. H. Anderson & Sons, 21 St. Aubin avenue, Detroit, Mich., have issued a series of catalogues dealing with contractors' tools for paving, sewer digging, grading, track laying, erection of buildings, laying conduit, installing water works and electric light plants, laying concrete pavements and numerous other tools used in all kinds of construction work in the modern city. Any of these catalogues may be had upon request.

—Julian Scholl & Co., 126 Liberty street, New York, has recently issued circular No. 37, which is copiously illustrated, and shows the use of the three-wheel double-cylinder steam road roller with compensating gear. The illustrations used show the roller in use upon the construction of New York State roads and, besides, contains information that is of interest and value to all who are engaged in the construction of macadam roads or streets.

—The Rand Drill Co. has just received the fourth edition of its catalogue "C" for air and gas compressors, which lists and describes various sizes of types of steam "Corliss," "Meyer" and plain belt gear and chain driven compressors, including articles on water impulse and sectional machines. The catalogue is well illustrated, and contains articles of a semi-technical character which explain clearly the phenomena attending compression and expansion of air; also a number of tables of much value to those interested in the study of air compression.

A 300-Foot Cold Storage Air Lift

THERE were six pump manufacturing concerns invited to bid on a recent job, and only two accepted the opportunity. This was the situation which confronted the engineers of the Pneumatic Engineering Co. when they undertook to install an air lift system in the plant of the Scranton Cold Storage and Warehouse Co., Scranton, Pa.

The well from which the water was to be pumped, is sunk 835 feet from the surface, passing through coal measures for a distance of almost 450 feet. The fact that coal surrounds the well for such a great distance was an additional obstacle to a successful installation, as it rendered the water poisonous and unfit for use. To overcome the contamination caused by the strata of coal, it was necessary to sink a casing 8 inches in diameter around the outside of the well for a distance of 450 feet, the casing then being filled with a thin cement composed of equal parts of clear Portland and sand.

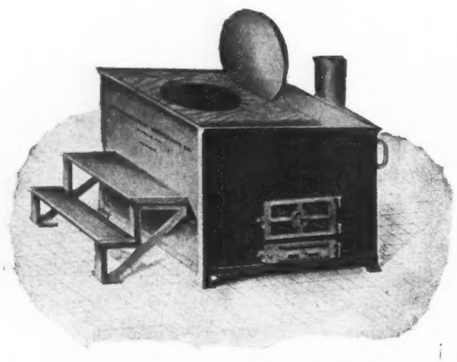
The air lift pipes were then submerged 500 feet, making a lift to the surface of 190 feet, and from this point pipes were led 104 feet to a tank placed on the roof of the building.

The power end of the system consists of one 12 x 11 x 16 straight line Rand compressor, a machine requiring very little attention and taking up a small amount of space.

The compressor was started at seventy-five revolutions per minute and at a pressure of 105 pounds lifted the water 294 feet at the rate of 8,000 gallons in ninety minutes, or 104,006 gallons every twenty-four hours.

Garbage Problem Solved

THE garbage problem, as related to American cities, has been slow of solution. Much time and money has been spent in producing a perfect method of disposing of the waste of the city. The items of economy, design, first cost in construction and operating expenses have been considered. After years of practical experience



THE INTERNATIONAL INCINERATOR

the International Garbage Incinerator Co., of 644 Prudential Building, Buffalo, N. Y., has solved this problem. It has been demonstrated that this concern has an incinerator which with either wood, coal or oil as fuel can dispose of waste of hospitals, private houses, schools, factories, and, in fact, waste of all kinds, in a sanitary and economical manner, without producing any disagreeable odor or effect. This method of disposing of garbage is adaptable to either the small village or large city. It is portable and can be placed in an attic, cellar, shed, or any place where there is flue or chimney, and is thus adapted for use in any private house. Its economy has been demonstrated by actual work. Its sanitary value is unquestionable, and its efficiency has always been shown wherever tried. For villages or towns where there is no sewerage system it solves the problem as to what is to be done with the waste of the household, including human excrement or night soil. A request for fuller information, addressed to the Company, will be promptly attended to.

Cost of Street Cleaning in Richmond

HENRY J. COHN, superintendent of street cleaning in Richmond, Va., undertook the solution of a difficult problem in the first year of his administration of that office. Neither the force nor the citizens understood the necessity for co-operation in the work, and the machinery was worn out and insufficient. What he has accomplished is shown but partially by his report, unless the circumstances under which the work has been done are considered. A total of 38,388,400 square yards of pavement have been swept; 119,270 loads of garbage, ashes, trash and snow have been hauled by forty-five carts; 17,163 blocks of gutters have been cleaned; 15,864 alleys cleaned; 537 streets scraped and 1,589 blocks cleaned of grass. The total expense of the department for 1902 was $60,784.50.

Public Utility Corporations Poor Tax Payers

MAYOR MCCORMICK, of Harrisburg, Pa., recently called attention to the small share of the burden of taxation borne by the public utility companies of that city in return for the valuable franchises which have been given them. The Harrisburg Traction Company pays one-half of one per cent. of its gross receipts, amounting to $2,485, and a tax on polls of $295, together with cleaning and keeping in repair the streets to a width of nine inches on either side of the track, estimated to cost $600 per year. The Harrisburg and Mechanicsburg Traction Company and the Light, Heat and Power Company pay a tax on polls only, as do the telegraph and telephone companies, anl the Steam Heat and Power Company pays about $100 a year license.

The mayor says: "The day has passed when public-service corporations are considered an experiment. The franchises they enjoy are known to be of great value at the time they are given and the city should receive some direct return for granting and continuing them."

London Tramways

THERE are in London about 115½ miles of tramways, of which eighty-eight miles have been purchased by the London County Council under the provisions of the tramway act, 1870, the remainder, about twenty-seven and one-half miles, are still in the hands of various tramway companies, nine in number.

The tramways owned by the council comprise on the north side of the Thames River the undertakings of the North Metropolitan and the London Street Tramways companies, a total length of forty-eight miles, and on the south side of the Thames the undertakings of the London, the Southeastern Metropolitan, and the South London Tramways companies, a total length of about forty miles. The tramways owned by the council on the north side of the Thames (forty-eight miles) are leased to the North Metropolitan Tramways Company for a period of fourteen years, expiring in 1910; those on the south side of the Thames (forty miles) are operated by the council itself.

The tramways act of 1870 provides that the local authority concerned may purchase compulsorily, after a period of twenty-one years from the date of the authorization by Parliament, any tramways constructed and operated by private companies.